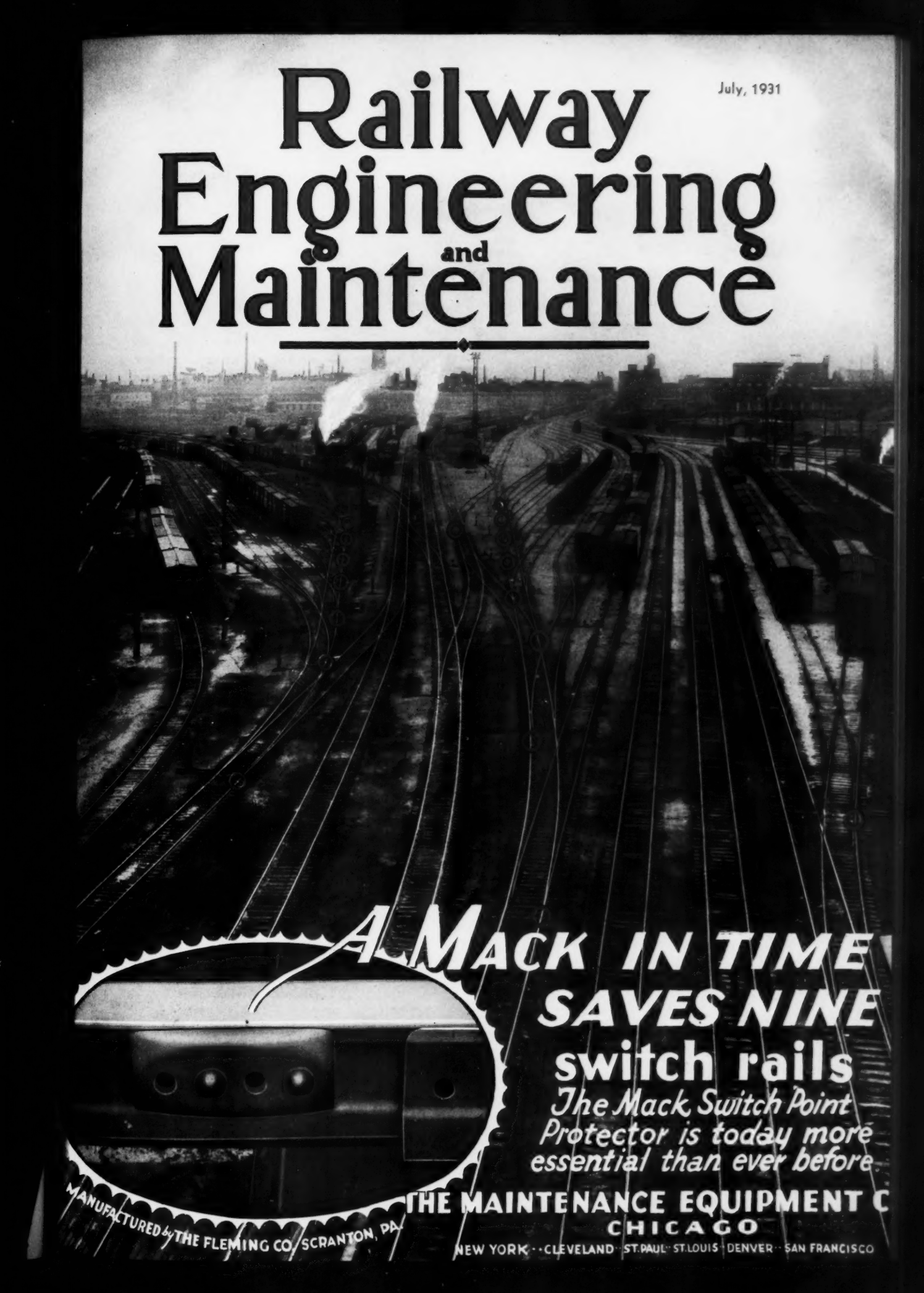
Railway Engineering and Maintenance

July, 1931



RAILWAY ENGINEERING AND MAINTENANCE

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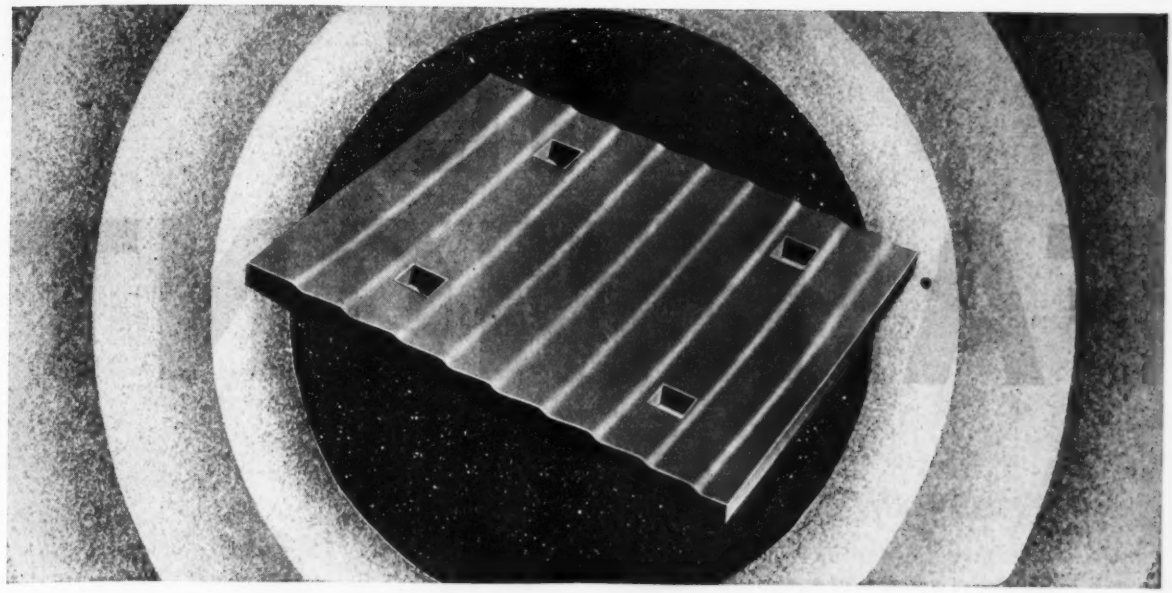

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THE LUNDIE TIE PLATE offers a design that eliminates tie destroying projections and is not encumbered with any attachments.

The Lundie Engineering Corporation

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HOLDS GAUGE WITHOUT TIE DESTRUCTION

ONE MAN DOES IT

The whole car weighs but 500 lbs.; the lift at rear end is only 110 lbs. Rail skids are standard equipment.

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Northwest Engineering Company

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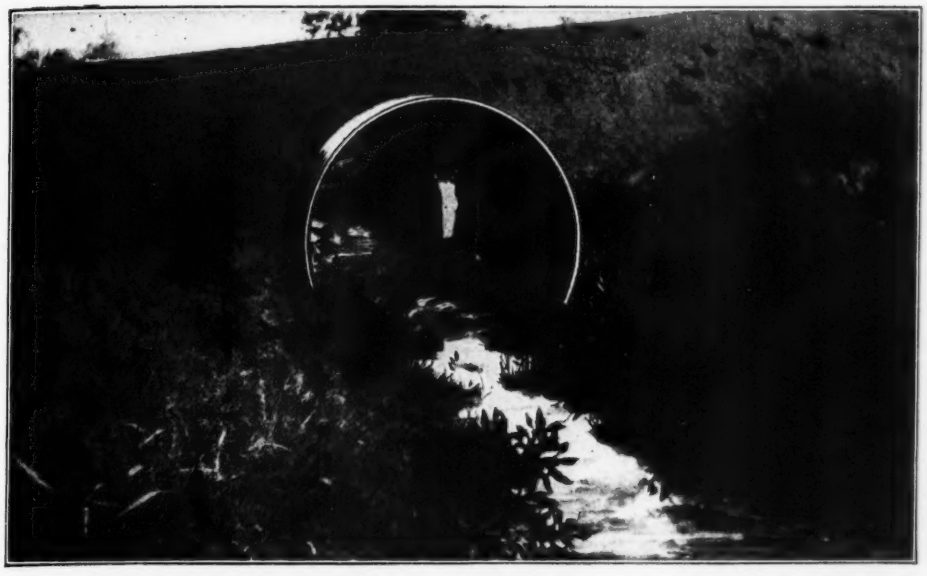
NORTHWEST



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21-B

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SHOVEL, DRAGLINE

a fast, new BUCYRUS-ERIE

(Crane rating 10 tons at 12 feet)

Another addition to Bucyrus-Erie's new line of universal machines.

More economical materials handling.

Greater combined speed, power and stability than ever before achieved in a machine of this size.

The 21-B is completely new. Yet every detail is tested for its ability to increase speed and economy. No other small excavator has so *many* features that cut operating costs.

Make a point-by-point check of the specifications, or inspect the machine itself. See it perform. Phone or write nearest branch office.

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A-328

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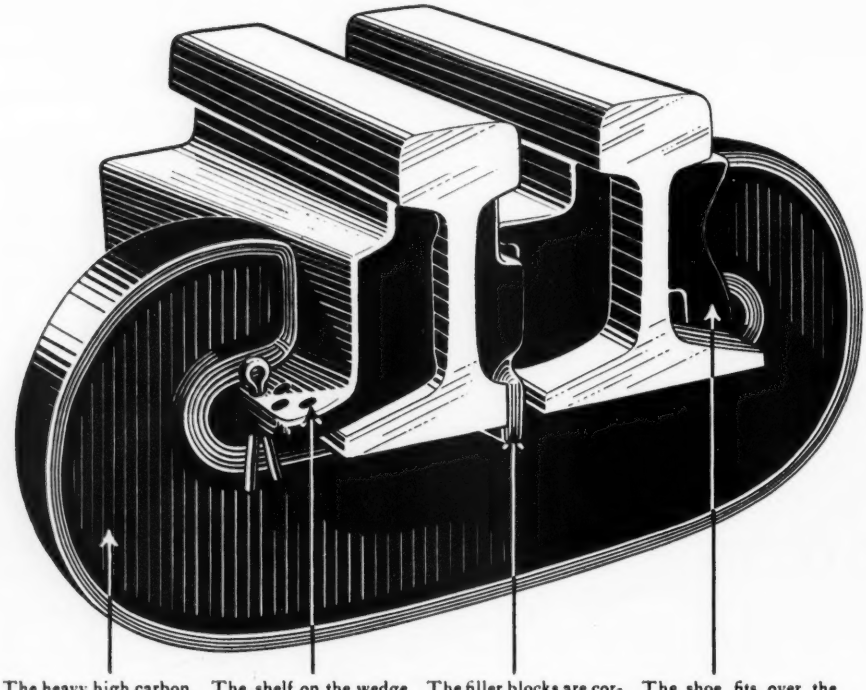


The heavy high carbon, drop forged yoke is reinforced with "I" beam construction and there are no groves or keyways to weaken the section.

The shelf on the wedge has a wide bearing surface and maintains the vertical alignment of the yoke. The holes being staggered permit a fine adjustment.

The filler blocks are corrugated to allow an adjustment of $\frac{1}{8}$" in steps of $\frac{1}{8}$" each. The depending lugs make it impossible for the blocks to creep.

The shoe fits over the end of the yoke to prevent creepage and is made to fit the head of the rail securely.

Where Service is Hard—
and there's plenty of it

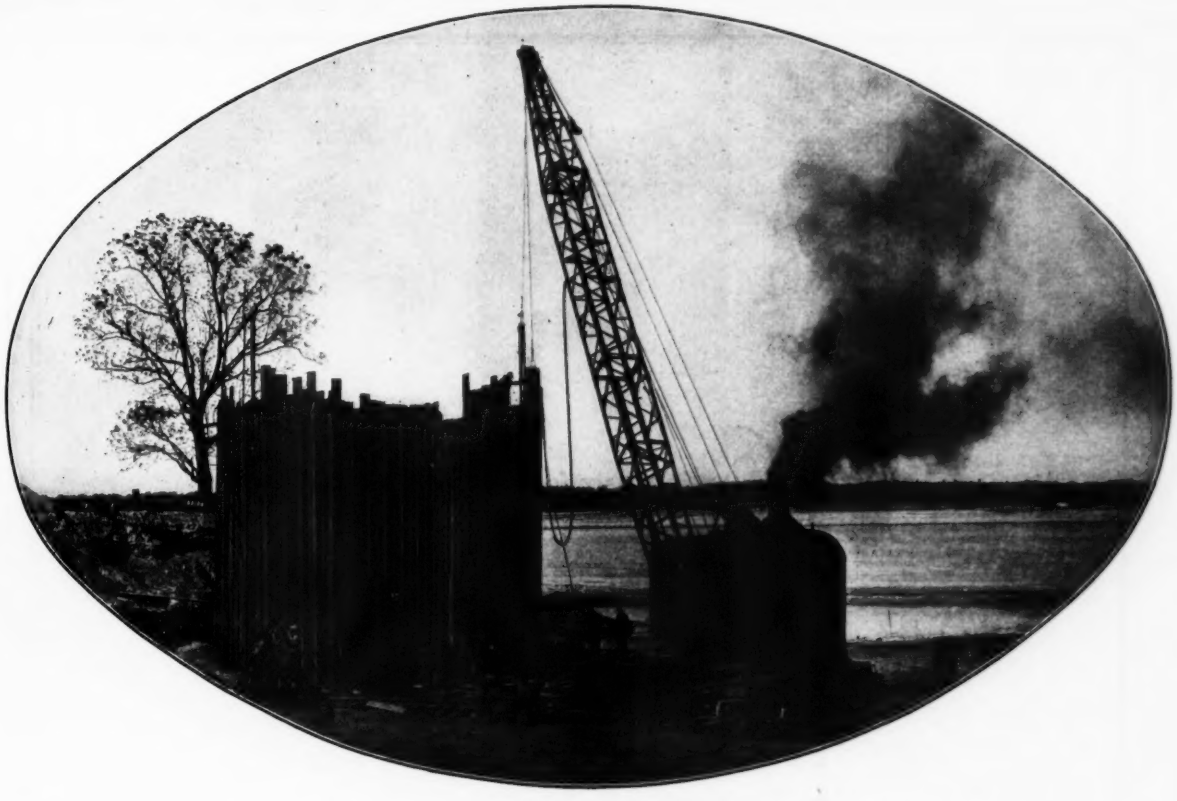
THE tremendous impacts, which the guard rail clamp of today is subjected to by the ever increasing weight and speed of equipment, is a big problem to maintenance men. To successfully meet this condition, we offer the Q & C Universal Guard Rail Clamp, which has exceptional strength and holding power under all traffic conditions. This clamp has a Universal yoke that will fit practically all rail sections by simply ordering new fittings. It is easy to apply and makes a firm installation.

Our Engineering Department will be glad to forward you further information and blue prints on request

The Q&C COMPANY, 90 West Street, New York

CHICAGO ST. LOUIS

The Q&C Universal Guard Rail Clamp



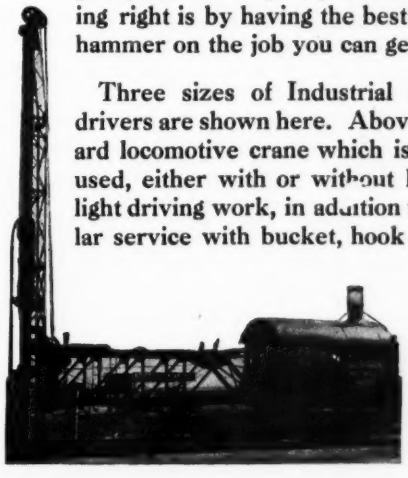
Having a Good Driver Is Half the Job

Well begun is half done. This saying is particularly true when you are driving piles, and the only way to be sure of starting right is by having the best driver and hammer on the job you can get.

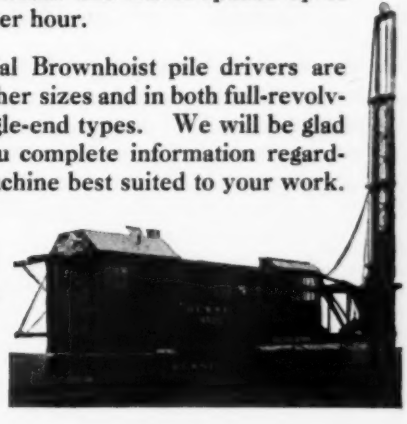
Three sizes of Industrial Brownhoist drivers are shown here. Above is a standard locomotive crane which is commonly used, either with or without leaders, for light driving work, in addition to the regular service with bucket, hook or magnet.

The illustrations below show two heavy-duty, full revolving drivers. Both are suited for either straight or batter driving and the machine at the right has a locomotive type boiler and travel speeds up to 20 miles per hour.

Industrial Brownhoist pile drivers are built in other sizes and in both full-revolving or single-end types. We will be glad to give you complete information regarding the machine best suited to your work.



Industrial Brownhoist steam pile hammers are double acting, using steam to raise the ram as well as to increase the force of the down stroke. These hard, rapid hammer blows are much more effective than those of single acting or gravity drop hammers.

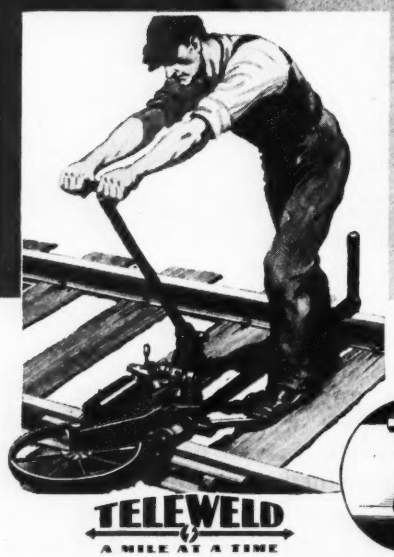


Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland.

INDUSTRIAL BROWNHOIST

One Two Three



A shaper bit quickly trims the rail ends to the desired angle

TELEWELD
A MILE AT A TIME

ONE..TWO..THREE. As simple as that the accurate Teleweld Slotting Tool trims and bevels rail ends . . measurably increasing the life of your new rail. It eliminates, once and for all, destructive end chipping, retards batter and defers reclamation of rail ends ◆ Approximately 3½ cents per joint pays for everything . . labor, upkeep, and returns the price of the tool after a year's service. One unskilled laborer conditions from one-half to one mile of track a day with this 110-pound unit. The savings it effects, by positively eliminating end chipping, are tremendous ◆ Place your order now for this tool before the life of your new rail is impaired by end chipping. The Teleweld unit is sold outright to you. Complete information will be sent on request.

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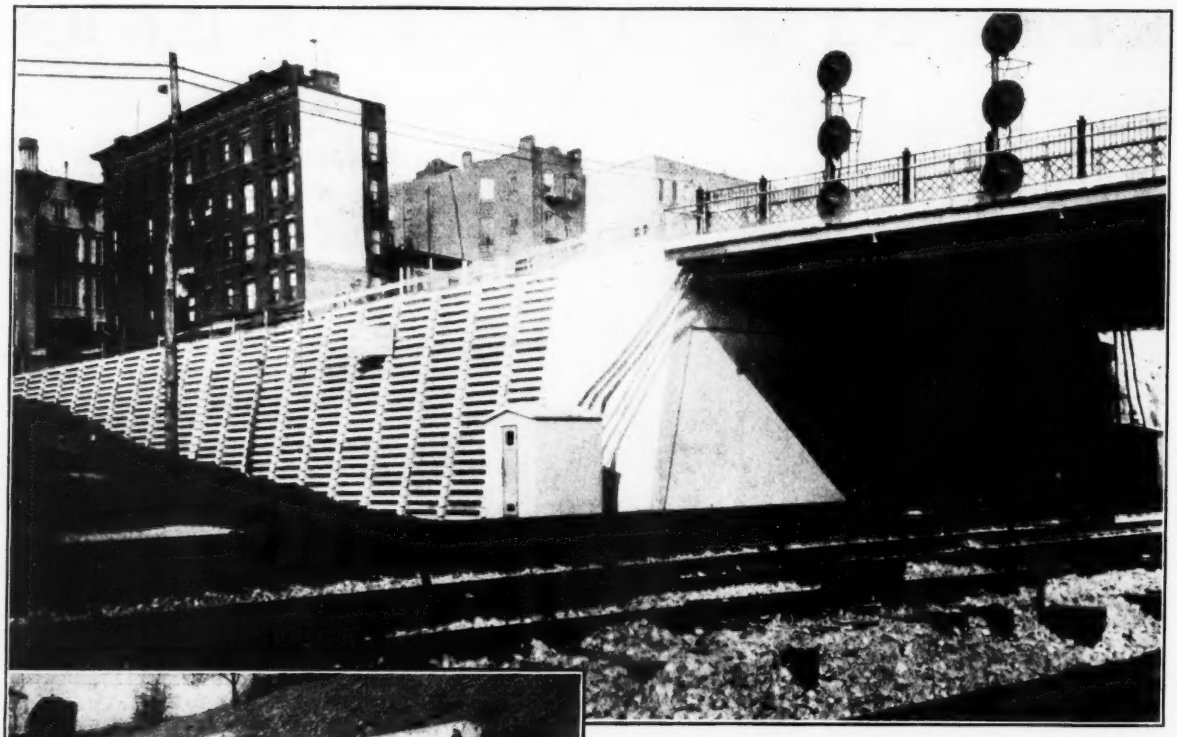
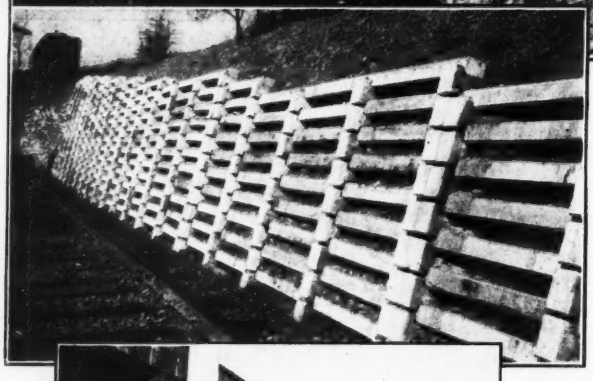
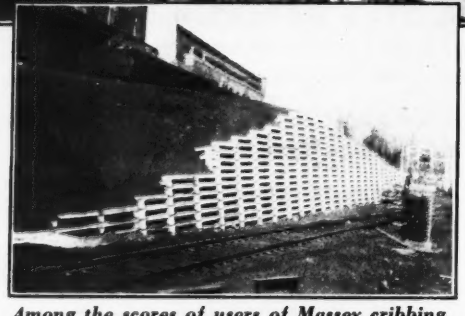
New York ◆ Cleveland ◆ Salt Lake City ◆ Boise ◆ Spokane ◆ San Francisco ◆ Montreal







Among the scores of users of Massey cribbing, the installations pictured above were made for the New York Central in New York, The Reading Company at Wayne Junction, Pa., and the Truscon Steel Company, Cincinnati.

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MASSEY

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No. 31 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: "Making the Column"

June 24, 1931

Dear Reader:

A distinguished columnist of a large metropolitan newspaper has made such a success of his column that his problem has become that of selecting for publication the best of the vast number of contributions submitted. To "make the column" has become an achievement of such note as to prompt the forming of a society of the successful contributors.

In some respects we have hoped to emulate this success in our "What's the Answer" department. Starting in January, 1921, we have published eight questions every month bearing on practical problems arising in the maintenance of railway structures, inviting our readers to submit answers drawn from their experience. The response to this invitation has been increasingly gratifying until we are now receiving more replies to many of the questions than we are able to publish. For this issue, for instance, we received 41 answers, 7 of which we were forced to omit because of lack of space and duplication of ideas. The time has arrived, therefore, when many of our readers consider it a mark of special merit for their contributions to be published in this department. The same recognition is implied on not a few railways in the mention of such success in the columns of the employee magazines. Thus in the Central of Georgia magazine for June, attention is called to answers in our May issue, prepared by J. J. Morgan, supervisor, and R. H. Gilkey, division engineer on that road.

We have many evidences that The Questions and Answers Department is a most popular and constructive feature of our paper. Not a few officers have written us that they are using these questions as topics for discussion at staff meetings with their foremen. The chief engineer maintenance of way of one of our largest railways suggested recently that we publish these questions and answers, now covering nearly 1,000 topics, in book form. During the last month, a division engineer wrote "we are strong for the Questions and Answers Department as a bang-up method of instruction."

It is our hope and endeavor that this department may continue to increase in popularity and in service among our readers. Nothing will do more than the stimulation of real competition among our readers in the preparation of the best possible answers to questions submitted. It is our sincere hope that you—chief engineer, division engineer, supervisor and foreman alike—will display the same interest in the Questions and Answers Department that the columnist's readers exhibit in "making the column."

Yours very truly,

Elmer T. Howson

ETH*MM

Editor.

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It is scientific, carefully controlled heat-treating of links, pins, gears and other parts that armors this tractor against shock and wear—that enables the "Caterpillar" owner to tackle his jobs with an assurance of uninterrupted service and timely completion—that guarantees to the "Caterpillar" purchaser highest returns on tractor investments—that adds to the eventual turn-in value of the "Caterpillar" track-type Tractors.

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An extra test lug is cast on final drive sprockets. "Caterpillar" metallurgists break these off and carefully examine them before accepting the sprockets.

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Track-type Tractors Combines Road Machinery

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TRACTOR

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

JULY, 1931

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3-IN-1 SWITCH STAND
STYLE NO. 100-A

After severe tests at such locations, many of the leading roads have now adopted the 3-in-1 switch stand as standard. None of the claims we have made for this stand were disproved during these tests. The 3-in-1 was especially designed for use at the ends of double track and passing siding. Its three features, all combined in one compact housing, are:

1. A rigid-throw always ready for hand operation.
2. Two automatic double-coil springs returning points after trailing train has passed.
3. An oil-buffer preventing return of points between successive pairs of wheels.

This is the first switch stand to combine all these features in one compact housing; in throwing it *cannot* be closed and locked when an object intervenes between the points and the stock rail. Many locations on your railroad need this switch stand. Write today for complete printed information about the 3-in-1.

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TRADE MARK

Railway Engineering and Maintenance

A CRISIS

Of Concern to Every Railway Employee

ON JUNE 16 the railways, through a committee of their presidents, initiated a measure that is of vital interest to every employee. On that date they filed with the Interstate Commerce Commission an application for a horizontal increase in freight rates of 15 per cent and asked that action on this application be expedited as an emergency measure. By this action the managements have undertaken to stem the trend of rapidly decreasing earnings and thereby maintain the solvency of the carriers and avoid a breakdown in their service.

Two Alternatives

In their petition to the commission the railways pointed out that when the decline in traffic set in late in 1929 they faced the necessity of adopting one of two alternatives. The first was a drastic retrenchment in operating and capital expenditures in anticipation of a substantial decline in traffic. The second was a normal program of operating and capital expenditures in anticipation of a return to normal traffic conditions. The first policy was open to the criticism that it would tend to intensify the business depression. It meant the immediate reduction of forces, depriving these men of their purchasing power, and the immediate curtailment of purchases of materials and supplies, depriving the industries producing these materials of a substantial part of their business and leading to the further reduction of forces in those industries.

The second policy was open to the criticism that it would continue in employment wage earners who were not actually needed and would provide additions to the capacity of the railroads when traffic had fallen below the present capacity, thus adding an investment on which no present return was possible.

After full consideration of these perplexing alternatives the railroads adopted the second policy and decided to continue, so far as possible, a normal program of expenditures. They adhered to it as long as it could be justified, as is shown by the fact that during 1930, in a period of declining traffic, they made capital expenditures amounting to approximately $598,000,000. They also retained employees whose services were not indispensably necessary to the transaction of the volume of business which was offered for transportation, thereby incurring operating expenses which might have been substantially diminished by a program of severe economy.

As every railway employee knows only too well, it became evident in the latter part of 1930 that the economic depression was world-wide in extent and was to be of more than ordinary duration and that the traffic of the railways was steadily decreasing. The return on the value of the railway properties of the Class I carriers of the United States diminished until it reached 3.54 per cent in 1930. As a result, the market prices of railway securities began to decline still further as railway earnings approached the point where the available income would fail to meet the relationship to fixed charges necessary to render them marketable to insurance companies, savings banks and trusts.

The measures open to railway managements to meet these conditions are limited. They cannot increase rates without the approval of the Commission. They cannot reduce wages without passing through the long procedure of conference and arbitration. They can lay off men and they can refuse to purchase supplies and to embark on new programs of capital expenditures. These steps have been taken during recent months to an extent that has brought both capital and maintenance expenditures far below normal and has resulted in the laying off of more than one hundred thousand maintenance of way employees.

The extent of this retrenchment is shown by the comparison of the expenditures for maintenance of way. The average annual expenditures for the Class I railways of the United States for this account for the five years from 1925 to 1929, inclusive, were $849,700,000, while similar expenditures for the year 1930 were $705,500,000. For the first four months of 1931, maintenance of way expenditures totaled $181,300,000 while in the corresponding period of 1930 they aggregated $235,600,000.

It is evident to every maintenance of way employee that these drastic economies are creating deferred maintenance which must some time be made up. It is equally evident that low as the rate of return on the value of the property has been during recent months it is in fact over-stated and is subject to very substantial reduction if this deferred maintenance should be deducted. Without making this deduction, however, the return for the first four months of 1931 was at the rate of only 2.24 per cent.

A High Degree of Operating Efficiency

The law requires that the railways be operated efficiently and economically. The following indices bear on this point. For the Class I carriers of the United States, the net ton-miles, revenue and non-revenue, per train-hour increased from 7,506 in 1921 to 10,839 in 1930.

Likewise the pounds of coal consumed per 1,000 gross ton-miles decreased from 162 in 1921 to 121 in 1930, effecting a saving in 1930 alone of 28,774,000 tons, based on the 1921 consumption. This achievement was recognized by President Hoover, then Secretary of Commerce, in his 1926 annual report in which he stated that, "probably the most outstanding single industrial accomplishment since the war has been the re-organization of our American railways. They have not only built up adequate service but they have greatly reduced transportation costs. The result of this great re-organization upon the whole economic fabric of the country has been far-reaching."

A Reduction in Wages

To meet the situation now confronting the railways the suggestion has been made that the necessary relief be secured through reductions in wages. In their brief to the commission the railways touched on this subject, referring to the policy of the federal government, concurred in by the managements of most leading industries, that the revival of industry and commerce should be predicated for the time being at least on the maintenance of existing wage scales. Because of this policy and because of the fact that even in the absence of such a policy the question of railway wages would require a long period for its disposal, the railways have not considered at this time the possibility of effecting reductions in wages.

In emergencies of this character, previous experience has shown that there is only one method that has ever been adopted by the carriers or by the commission to afford the necessary relief. This is a percentage increase in rates. It was employed by the director general during the period of federal control. It was employed by the railways, with the approval of the commission, upon the return of the roads from federal control. It was employed by the commission on its own motion in 1922 when it prescribed a reduction of 10 per cent in freight rates. No other method is available now if relief is to be secured in time to meet the situation.

With the loss in passenger traffic that the railways are already suffering to competing carriers, it is evident that no increase in rates can be made effective here. The railways have, therefore, asked the commission for authority to increase all freight rates and charges uniformly 15 per cent, with certain adjustments to preserve existing differentials. Even with this increase, it is estimated that the net railway operating income of the roads will be less than 4 per cent or still far below that prescribed by law.

The Employees' Part

In no recent period have the interests of the railways and of their employees been so largely the same. No employee today can fail to recognize the fact that the ability of his road to provide him and his associates with employment is limited directly by its earnings and the further fact that the continuity of his employment depends upon the securing of increased income by the roads. It is, therefore, of as direct concern to him as to his railway that the Interstate Commerce Commission act favorably on the petition which the roads have presented.

Of major importance in the decision on this application will be a fully and clearly informed public opinion. To this end, if every employee will fully inform himself regarding the present situation and will then see to it that every person with whom he comes in contact, and especially patrons of his road, is fully informed regarding the present condition and needs of the railways and regarding the basic importance of an efficient system of railways to American industry, he will not only protect his own interest and promote those of his employer but will render a public service of no small magnitude by aiding in preventing a serious break down of our chief system of national transportation.

WATER "SERVICE"

Is Station Operation Adequately Supervised?

IN THE pioneer days of railroading, the engineer was concerned primarily with construction. Many years passed before the managements began to realize the need for centralized control of maintenance under an engineering officer. When the advent of water treatment created a demand for the services of men who could deal intelligently with the problems in this new field, the duties imposed were largely concerned with the design and construction of water treating plants. While it is true that the water engineer has exercised considerable authority over plant operation and maintenance, the expansion in the scope of his duties has had to do mainly with construction; he was made responsible for the design and construction of all water service facilities. Maintenance and operation in many cases have come only indirectly under his supervision. In other words, control of water service is still largely in the first stage of development. To a great extent, there is as yet no counterpart for the engineer of track maintenance in water-service work.

This statement may be questioned, but the further question may be asked whether the cost of operating and maintaining existing plants is subject to the same careful scrutiny as is given the selection of pumping equipment for a new plant to insure that the most economical type will be installed. It is to be expected that the division staff, during this period of curtailed traffic, will be alert to shut down certain of the less efficient plants so that the water needed may be supplied by plants where the cost of pumping is lower. But is it equally certain that plants that provide an adequate supply and give no trouble in operation, but produce water at excessive cost, will be subjected to study to determine the possible justification of a replacement? Are the causes of high maintenance costs being investigated in all cases?

These are problems for the staff officer, for the line or division officers are necessarily concerned primarily with the reliability of facilities that have to do with transportation. Some engineers of water service have a definite responsibility in connection with the operation and maintenance of water stations and others are taking the initiative in doing what they can to co-operate with the work of the division organizations. However, there is an opportunity for a profitable study of the plan of organization of water service on many properties.

FOLLOW UP

Safety First Work Will Fail Without It

WHEN the foreman of a rail-laying gang holds the chisel to cut a rail without wearing goggles, it is evident that something is wrong with the administration of safety work. Yet this violation of a fundamental rule of safe practice was observed recently on a railroad that has enjoyed a very low casualty rate. Obviously, no man or organization should be indicted for a single lapse, but in this same gang the operator of an adzing machine wore no goggles, while the failure to avoid the crowding of the various operations of the gang, the close bunching of spikers, etc., indicated clearly that the foreman was not being checked up on his observance of safety rules.

Safety supervisors have not infrequently been designated as loquacious pests. But, as has been proved so often in the past, success in safety demands persistent follow-up work, and the safety officer must keep the subject constantly before railway workers. He can, however, accomplish little if he does not receive the support of the officers of the other departments, in fact the responsibility for the safety of track men lies primarily with the track supervisor or the roadmaster and through him should be imposed on the foreman. After all that has been said and written on this subject in the last fifteen years no railway officer can plead that he is not familiar with the essential rules of safe practice or offer any excuse for not insisting that they be observed.

MAINTENANCE

What It Costs and How It Affects Industry

IT IS of more passing interest than the Norfolk & Western magazine for June publishes and analyzes certain statistics showing what it costs to maintain and improve the fixed property of that road for one year. Last year it spent $11,831,477 on maintenance alone and $6,832,596 for improvements and additions to its property. The cost of maintaining one mile of its double-track line was $5,282.38.

This road has 2,860 miles of main track, including branches. As an indication of its standards of maintenance, 1,636 miles, for more than half of its main-track mileage, is laid with 130-lb. rail, and the annual requirements for rail of this section approximate 50,000 tons, at a cost of $2,300,000.

To lay this rail and provide the material required for normal maintenance, it also used 2,885,807 creosoted tie plugs, 344,801 track bolts and 4,231,857 track spikes, 823 frogs, 444 switches, 85 derails, 1,135 guard rails and 2,018 guard rail clamps This by no means exhausts the list, which also includes anti-creepers, tie plates, switch stands and numerous other appliances. In addition, 761,-159 ties were renewed at a cost, not including labor, of more than $1,000,000, while 473,659 cu. yd. of ballast was applied in maintenance.

To facilitate the laying of the heavy-section rail, 22 rail laying machines, representing an investment of $110,000, are in service, while 7 ballast-cleaning machines, which cost $70,000, are in constant use from April 1 to December 1 every year. Being a mountain railroad, the rail wear on the many curves assumes a large importance, and to reduce this wear 161 rail-and-flange oilers have been installed with excellent results.

During the past 30 years, the investment in signals and interlockings has increased from $15,000 to $11,-500,000, while it costs $650,000 a year to maintain them. It also cost nearly as much, $608,211, to maintain the 1,634 bridges, representing a total length of 38 line miles.

Only a few selected examples have been given of the more than 70,000 individual items which are purchased annually by the railways of North America. These few are sufficient, however, to indicate the importance of the railways in the industrial life of the country. When the magnitude of the material requirements of all of the railways is considered, it is easy to understand why, when it becomes necessary for them to curtail their purchases, the ill effect of this retrenchment is so quickly felt throughout the entire industrial structure.

CAR BODIES

Should They Be Used as Make-Shift Buildings ?

NO ONE knows when a box car body was first transferred from its trucks to some mudsills where it served thereafter as a railway building, but the practice is so old that such use of old car bodies has long been considered a primary rule of economy. Briefly, the car body is the original unit-built house available at a nominal cost.

It is to be questioned, however, whether car-body houses are as cheap as is generally assumed. Granting that the charge made for the body itself is small, there is the cost of setting it in place with a derrick car, or if time permits, with jacks and house-moving equipment, as well as the cost of providing doors and windows suitable for the nature of occupancy. There is also the question as to whether the converted car body is well adapted to the use intended. No manufacturer of unit buildings could do business wth only one size of unit. He would find that it was too large for some purposes, too small for others, and that its shape was ill adapted to the attainment of efficiency for many uses.

There is also to be considered the unsightly appearance of the car body when used as a building, especially the "shanty town" effect produced in or near terminals where one car body after another has been added to a group to satisfy the needs of this or that department. There is a need for a real study of the requirements of the more common uses to which these old box-car bodies are being put to ascertain whether they cannot be satisfied better by buildings designed for the purpose, whether there are locations where one building of adequate proportions cannot take the place of several independent box-car houses, and what economy if any is being realized by using car bodies at all. The fact that the costs of building materials have been greatly reduced should have some influence on the results.

Fourteen Years of Concrete Lining on the Southern Pacific

Within the Tehachapi Tunnel, Showing Concrete Sills in, Reinforcing Steel Set, and Steel Forms Ready to be Released and Moved Forward in the tunnel

In protecting more than many miles of tunnels on this railroad every conceivable many "best

IN LINING with concrete about 27,000 ft. of the 196,260 lin. ft. of tunnels on its lines during the last 14 years, the Southern Pacific has gained unusually wide experience in tunnel-lining work and has developed a number of highly effective and economical methods and practices which should be of considerable interest and assistance to other roads.

Confronted with more than 37 miles of tunnels, penetrating at one point or another almost every conceivable class of material from soft muck to the hardest rock, this road has always had tunnel problems to contend with, including enlarging, timbering and retimbering, and guarding against the hazards of falling material in unlined tunnels and of fire in those lined with timber. For years timber lining had been standard on the Southern Pacific in those tunnels where lining was necessary, and the extent of this work is seen in the fact that in 1917 there were 123,604 lin. ft. of this type of lining on the road, 84,756 ft. of which were in main line tunnels.

Owing to the problem of maintaining this large amount of timber lining, concrete lining was tried from time to time after about 1910, but it was not until 1917 that the Southern Pacific undertook actively a large program of concrete lining work. Continuing this program from year to year, this road has lined a total of 27,120 lin. ft. of tunnels with concrete, practically all single-track tunnels in main line territory.

Concrete lining for tunnels was adopted by the Southern Pacific not only as another step in the general improvement of its lines, but, more specifically, because of its permanence as compared with timber, to reduce tunnel lining renewals and maintenance, and to minimize fire hazard. This latter factor has always been one of paramount importance, not only because of the damage and economic loss caused by fires within the tunnels, but of greater consequence in many cases, the blocking of all train service over the line. While not controlling factors, the improved appearance of the concrete lining and the fact that the removal of smoke is much more rapid in tunnels lined with concrete also had a bearing on the decision to use concrete generally. The single feature detracting from concrete-lined tunnels seems to be that they are subject to higher temperatures than tunnels of equal clearance lined with timber.

Old Conditions Exist in Many Tunnels

In formulating the program of concrete lining on the Southern Pacific from year to year, consideration is given first to those tunnels where the timber lining is in most need of repair, or where there is interference with train operation because of close clearances. This latter factor is one of considerable importance in many of the tunnels built in the days of much lighter and smaller power, because resetting of the timbering to receive the concrete lining involves, in many cases, as much work as the lining itself.

In most of the old timber-lined tunnels the timbering consists of three-segment arches supported on wall posts which are battered in toward the track at the bottom and set on foot blocks. These timbers, which are usually 10 in. by 14 in. in section and generally spaced 3 ft. or 4 ft. center to center, are backed with plank lagging. Clearance in practically all of the old timber-lined tunnels is less than required by present standards, necessitating resetting of the timbers before the concrete work can be started. In fact, the timber has to be set back to a greater or less extent throughout all of the tunnels to be lined because of the fact that the timber lining itself must permit in excess of present standard clearances in order that standard clearances may obtain after the concrete lining has been installed inside the timber.

The standard single-track, concrete-lined tunnel section on the Southern Pacific has, as shown in the accompanying illustration, vertical side walls and a circular arch, with a clear height at crown of 22 ft. above the top of rail. The clear width of the tunnel section on

Tunnel-Lining Work Pacific

27,000 lin. ft. in almost class of material has developed practices"

Steel Frame Forms in Place, Ready for Pouring. Note Adjustable Features of Forms and Concrete Discharge Line Rising Up Along Right Hand Wall

tangents and on curves up to 2 deg. is 16 ft., and on curves from 2 deg. to 10 deg., 17 ft. In tunnels where both tangent and curved track occurs and the tangent is 200 ft. or less in length, the required width for the curved portion is used throughout. Where the length of tangent is more than 200 ft., the width required for tunnels on tangent track is maintained to a point 50 ft. ahead of the point of curve, from which it is widened gradually to the full width required for the curved section, at the point of curve.

Where the bents of timber lining are spaced four feet or more center to center in tunnels to be lined with concrete, the concrete lining is made to extend 9 in. below the face of the bent timbers in the crown of the lining, and 6 in. inside the face of the timbers along the side walls, but where the bents are spaced 3 ft. center to center, the concrete lining is made 9 in. inside the timbers along the side walls as well as in the crown. Where the bents are 2 ft. or as little as 1½ ft. center to center, which is not uncommon where trouble has been experienced, every second bent is removed just prior to concreting and the walls are made 6 in. or 9 in. thick inside the timbers, depending upon the spacing of the remaining bents.

Retimbering is Usually Heavy

As indicated in the foregoing, one of the largest phases of the problem of lining tunnels on the Southern Pacific has been and continues to be the resetting and repair of old timber linings, this, in many cases, exceeding in cost that of the concrete lining work. In this work, which varies in extent considerably in different tunnels and even in the same tunnel, all decayed or weakened timber is renewed and the timbers are set back along the walls and raised in the arch to provide the clearances called for in the road's present standard for timber-lined tunnels. This standard provides clearances sufficiently in excess of those required in concrete-lined tunnels to permit the application of a concrete lining in later years without the necessity of resetting the timber.

In carrying out the work of resetting the timber lining of a tunnel to be lined with concrete, the first step is to construct new concrete footings along both sides of the tunnel, back of the old battered wall posts at such distance apart that the old timbers, when set back on them, will be spaced suitably to receive the concrete lining. To do this work, it has been necessary to cut back into the side walls of the tunnel to provide the additional width required, this being done with pneumatic drills where it is necessary or advisable to speed up the work. Enlarging and heightening the crowns of the tunnels is also done by breaking down the material penetrated, this being done carefully by removing only one bent at a time.

In places where the crown has to be raised several feet, a central drift is put through above the old timbering and is then widened out to the spring line on each side, entirely in the clear of traffic. As the enlargement work progresses from bent to bent, the timbering is replaced, using such new timber as is found necessary in providing for the increased height and size of the arch ring.

In carrying out this work, all of which is done under traffic, the force employed varies from four to ten men, depending upon the extent of the work. This force operates entirely independent of the lining forces and is kept far in advance of the lining work so as not to interfere with that work.

Because of the limited room in the tunnels, practically all of the cutting of the lining timbers is done outside the tunnels where adequate power saws can be set up to handle the work more economically and quickly. Materials are moved into the tunnels largely with push cars and trailers, which are also used to remove the old timbers released and the material broken down in enlarging the tunnels.

In carrying out the concrete lining work during the

last 14 years, wide experience has been gained, and, as may be expected with several lining crews working at different points at the same time, details of the methods adopted and employed by the different crews at the present time vary somewhat with differing conditions. In general, however, the methods employed in all of the tunnel work are similar, the improvements developed from time to time being adopted generally as they prove of definite merit. In certain cases the equipment used varies with the character and extent of the work and because of replacements with equipment of later design. For example, adjustable steel forms have been used in certain of the more recent work on some of the tunnels, instead of the adjustable wooden forms which were used altogether in the earlier work. Similarly, while station-

The Car-Mounted Pneumatic Concrete Placing Unit of the Southern Pacific, Used on the Smaller Lining Jobs

ary air compressors are employed outside the larger tunnels and the concrete is generally mixed inside such tunnels, the Southern Pacific has a car-mounted compressor outfit and a car-mounted concrete plant, both of which are used in the work of lining short tunnels or in the placing of short sections of concrete lining in certain other tunnels where the extent of the work does not justify the setting up of a more permanent plant.

All of the concrete used in the tunnel lining work in recent years has been mixed and placed by Ransome ¼-yd. pneumatic concrete placers. The concrete is of 1-2-4 mix, with the water carefully controlled from a measuring drum located directly at the placer. The course aggregate used is either regular ballast grade stone or specially graded rock passing a 2-in. ring.

"Shooting" of Concrete Limited to 2,500 ft.

In lining tunnels more than 2,500 ft. in length, charging of the concrete placers is generally done within the tunnels, the concrete placer being set up in a recess or working chamber cut in the side of the tunnel at the point where it will be most effective in distributing the concrete. Ordinarily these chambers are made about 12 ft. long, 6 ft. deep and 8 ft. high, sufficient in size to house about one-half carload of cement in addition to the concrete placer. Aggregates used in the concrete are stored along the sides of the tunnel both ways from the working chamber, and are brought to the placer in wheelbarrow loads of the proper volume for individual charges.

Handling of the concrete to the forms is all done by air pressure through a 6-in. wrought iron pipe line, lengthened or shortened as necessary by the addition or removal of pipe sections. In fact, practically all of the mixing of the concrete is done in the distribution line during transit, as no attempt is made to mix the cement, aggregates and water in the hopper of the concrete placer.

The mixing, distributing and placing of the concrete in this manner has been found very effective with only a few general precautions to be followed in order to secure the best results in the way of quality concrete and efficiency. In the first place, it has been found that the most effective results can be secured by placing the concrete within the range of 300 ft. to 2,500 ft. from the placer unit itself, at least 300 ft. of transit in the pipe being necessary to secure adequate mixing of the concrete on the one hand, and transit of the concrete in excess of 2,500 ft., wasteful of time, on the other hand.

It has been demonstrated that the concrete can be "shot" as far as 4,500 ft. without bad effects upon it, but since only one charge can be in transit in the distribution line at a time, and it requires about two minutes for a charge to move approximately 4,000 ft., the charging gang is delayed considerably in its work and the men at the forms receive batches of concrete only about every two or three minutes when the concrete is shot this distance. By keeping the length of the line down to 2,500 ft. or less, the interval between the depositing of the concrete charge and its receipt at the forms is cut down to the point where both the charging and receiving crews can be kept busy constantly. This results in a largely increased volume of concrete being handled.

Special Pipe Line Joint Designed

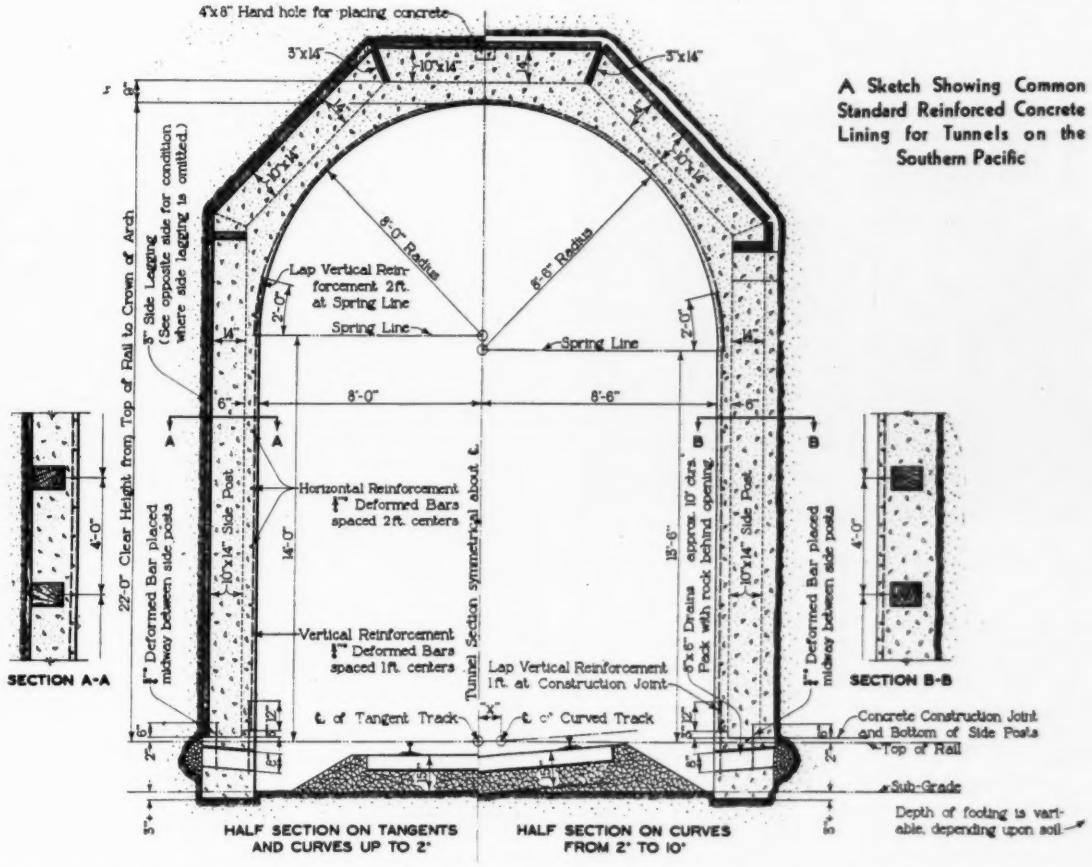
The six-inch distribution line, which is laid along the floor on one side of the tunnel, has been found best suited for transporting the concrete, and very little trouble has been experienced with clogging. When a clog occurs, men stationed along the line strike the pipe with a light hand maul or hammer just in advance of the clog, this being sufficient usually to start the movement of the concrete mass. In some cases it has been necessary to break the pipe line at the joint nearest the clog in order to start the concrete moving.

With the idea of making it possible to shorten or increase the length of the line readily as the work progressed, and also to make it readily possible to remove a length of pipe which may have become clogged, flanged joints with six bolts were used in all of the early distribution pipe line installations and proved quite effective. A few years ago, however, a foreman engaged in the lining work developed a special type of joint for the distribution lines, which has proved more effective in saving time than the flanged joint, and which is now being used quite generally in the tunnel lining work.

This special joint consists essentially of one-half of a standard threaded six-inch coupling, slit throughout its length at right angles to the threads, and a two-part steel strap clamp about two inches wide and one-half inch thick, each part in the form of a semi-circle, with a single bolt draw-up on each side. Using this type of joint, the split section of coupling is sprung over the end of one length of pipe and is held open while the adjoining pipe is slipped into the free end of the coupling. The two-part band clamp is then slipped over the coupling and the bolt assembly tightened to hold the coupling securely in place. With this type of joint, any length of pipe in the line can be removed for inspection and the line can be extended or shortened without disturbing the remainder

of the line. In either case, it is only a matter of loosening two nuts, springing the slit coupling apart and sliding the joint parts one way or the other.

The only serious trouble which has been encountered in connection with the distribution pipe lines has been the wearing out of the pipe at bends, particularly where the lines are carried up from the floor of the tunnel to the form heading, but even this problem has been solved quite satisfactorily. Ninety-degree bends of manganese steel wore out rapidly in the earlier pipe installations, as did also 45-deg. bends of the same material. Sheet iron strapped around the worn bends extended their life somewhat, but in seeking a better solution of the problem, and air was required also at the form headings and for boosting the water supply pressure, two stationary-type compressors were used, each having a capacity of 1,100 cu. ft. of free air per minute and being driven by a 100-hp. electric motor. On certain shorter tunnels a single stationary-type compressor of 1,145 cu. ft. capacity has been used, and on several of the shortest tunnels lined, the car-mounted compressor unit of 850 cu. ft. capacity, belt-connected to a 160-hp. gasoline engine and set out on a temporary spur track near the tunnel portals, was found suitable and adequate. In most cases, regardless of the compressor equipment used, it has been found necessary to supplement the compressors with large



A Sketch Showing Common Standard Reinforced Concrete Lining for Tunnels on the Southern Pacific

22½-deg. bends of manganese steel, heavily reinforced on the outside and about 20 in. in length, were resorted to, these being used at both the bottom and top of the riser at the discharge end of the line. This type of bend has proved very effective in permitting the free movement of the concrete through it and in resisting the abrasive wear to which it is subjected.

Air Supplied From Outside of Tunnel

Air for the operation of the concrete placers is, in all cases, furnished by compressors set up outside the tunnels being lined, with steel pipe connection to the placer units. The compressors employed also furnish air to the lining form headings for use in blowing the concrete into place and, in some cases, are also used to force water into the tunnel for use in the concrete mixers. Different compressor layouts are used on the various jobs, depending largely upon the air requirements in the work. On certain of the longer tunnels already lined, where the concrete was blown over long distances capacity air storage tanks in order to be assured of adequate pressure for shooting the concrete and for auxiliary purposes. Without the storage tanks, much larger compressors would be required or the work would be subject to many delays because of the inadequacy of the air supply.

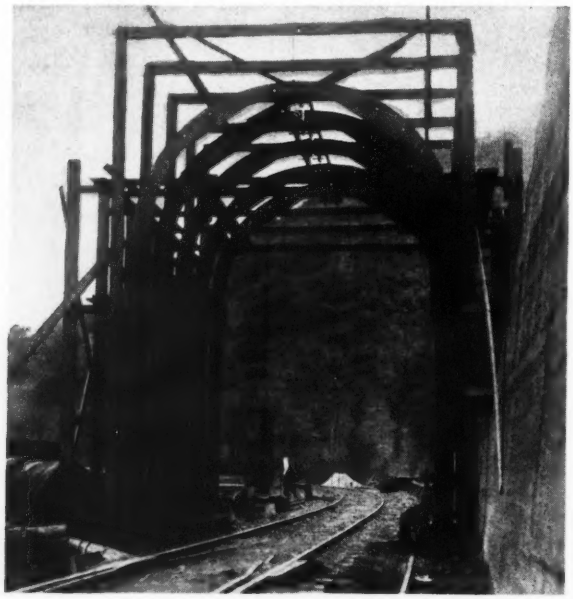
Both Wooden and Steel Frame Forms Used

The forms used in the lining work have, for the most part, been of wood, although steel forms have been used to some extent in recent years. In both cases, however, the forms are designed especially for the work so that they can be moved readily from one point to another and do not interfere with traffic.

The wooden forms consist essentially of timber framing covered with lagging, the arch section at the top being supported by inside adjustable bracing, the lowest members of which are 17½ ft. above the top of rail. Through the adjustable feature of the bracing, which merely allows the sides of the forms to be drawn in or

moved outward, the top of the form can be readily freed from the concrete after it has set up.

The foundation used for carrying the wooden forms consists of a heavy timber sill along each side of the tunnel, set to proper line and elevation. This sill carries pipe rollers on which rest the lower sills of the framework itself when the form is lowered and ready for movement. In adjusting the form for pouring, the entire form is jacked up into true position, the arch bracing is expanded to the neat line of the finished lining, and



A Section of Steel Frame Formwork Erected Outside of a Tunnel and Ready to Be Lagged Up

the form as a whole is held to this position by ramming sand between the foundation sill and the form footing sill, after which the jacks may be removed. In lowering a section of the wooden forms, the jacks are again applied, the sand blocking is dug out, the arch bracing is drawn inward and the jacks are then lowered to set the form on the pipe rollers for movement.

The steel frame forms consist essentially of structural steel bents covered with timber lagging and carried on two pairs of double-flanged wheels which run on light sections of steel rails that are carefully lined up and supported to carry the forms. The wheel carriages on both sides of the forms are provided with screw jacks so that the forms can be raised or lowered within a range of several inches. Adjustment at the top of the forms is provided both by a pivoted adjustable joint at the top of each of the rings of the form framing, and by horizontal adjustable compression members between opposite sides of the form-framing rings, about 17½ ft. above the top of the track rails. A general idea of these features in the steel forms may be gained from the accompanying illustrations.

Nine to Twelve Feet Lined in Eight Hours

All of the concrete lining on the Southern Pacific is reinforced both horizontally and vertically with deformed bars, the reinforcing consisting of ¾-in. bars placed horizontally, two feet center to center, and similar bars placed vertically and over the arch crown, one foot center to center. All of the reinforcing is fastened firmly to the old timbering and at such a distance from it that it will have a two-inch cover in the finished lining, and is then wired together into a solid mat to receive the concrete.

In all of the lining work, complete sections of the side walls and arch ring are poured at one time, no horizontal construction joints being permitted. The length of section poured each day varies with the conditions encountered, but ordinarily ranges from 9 ft. to 12 ft. in length, depending upon the distance of pouring from the intake of the concrete placer. As mentioned previously, it has been found advisable to limit the length of shooting to about 2,500 ft., which makes it possible to pour at least a 9-ft. section in 8 hours. Limiting the length of shots necessitates the cutting of additional chambers in certain of the longer tunnels to house the concrete placer and cement, but this is felt to be more economical than trying to shoot the concrete in excess of 2,500 ft.

Three Pouring Sections

In order to speed up the work where the section of lining to be installed is in excess of 900 ft. in length, it has been the policy to carry the work forward in three working sections, adjacent to each other, and each about 300 ft. long. This arrangement involves a riser pipe from the concrete line at each section, three sets of forms and some duplication of auxiliary equipment, but allows pouring to continue day after day uninterrupted by auxiliary work. Thus, while pouring is being done in one section, the concrete poured the previous day in one of the other sections is allowed to set up, and the forms and pipe are removed from the work done two days previous and placed for pouring the following day.

In all cases the concrete is shot into the forms at the top of the arch crown and allowed to fall into the side walls and the arch ring, the discharge end of the concrete line being made to project slightly through a hole provided in the top of the form bulkhead. Two men at the heading direct the concrete into the forms and prevent its piling up directly in front of the pipe discharge. This work is facilitated by the use of compressed air through a long curved nozzle, which blows the concrete back of the wall forms as it comes from the delivery line and at the same time prevents segregation of mortar and aggregates. The nozzle is also used to force the concrete up against the side wall forms.

In addition to distributing a few men along the concrete line to eliminate obstructions which arise from time to time, only two other precautions have been found necessary to insure effective performance of the concrete placers. One of these is to flush the concrete line thoroughly at the end of each day's work to prevent its becoming fouled with concrete, and the other is to coat the inside of the line thoroughly with a rich grout at the beginning of each day's pour to prevent the first few charges of concrete from being robbed of their mortar.

Flushing of the line with water is a simple operation, the water being sent through in successive slugs similar to the concrete charges, and being wasted on the floor of the tunnel. Grouting of the line before pouring each day is done by sending through a batch of lean cement mortar, using about six bags of cement in the charge. What remains of this charge at the point of pouring is shot into the forms and mixed with the successive batches of concrete which follow immediately. Changing of the line discharged from one point of pouring to another is a matter only of removing a length of pipe from the line and moving the riser pipe back.

Upon the completion of the lining work in a tunnel, or upon moving the concrete placer to a new location,

the chamber occupied by the placer is reduced in size and is lined with concrete to form a safety bay of sufficient area to hold a motor or push car.

Lining Gangs Are Relatively Small

In addition to about eight men employed in setting up the reinforcing and moving forms, the concreting gangs on the Southern Pacific usually consist of 15 to 18 men, depending upon the length of the concrete lines and the number of men required along the lines to start moving such plugs as may form. One man is employed at the concrete placer itself, making up the charges, five or six men handle the aggregates, one man handles the cement, another man is in charge of the compressor equipment at the tunnel portal, and two men are employed at the heading directing the concrete into the forms. The remaining men in the gangs are stationed along the concrete line to clear up obstructions.

All of the work in the tunnels is illuminated with electric lights, and, since the work is carried on without interference to train operations, thorough protection is afforded the men and train movements at all times. During the working hours, all trains are operated through the tunnels under slow orders, while flagmen at each end of the tunnels inform the different gangs at work of all train movements. These flagmen have direct telephone connection with the nearest despatcher's office and other phone connections directly with the concrete placer chamber, the men in the form heading, the reinforcing gang and the men engaged in setting back and renewing the old tunnel timbers. By employing a code of rings for the different groups of men, all of the different groups can be kept advised of train movements, or messages can be directed to any particular group without bothering the men in the other groups.

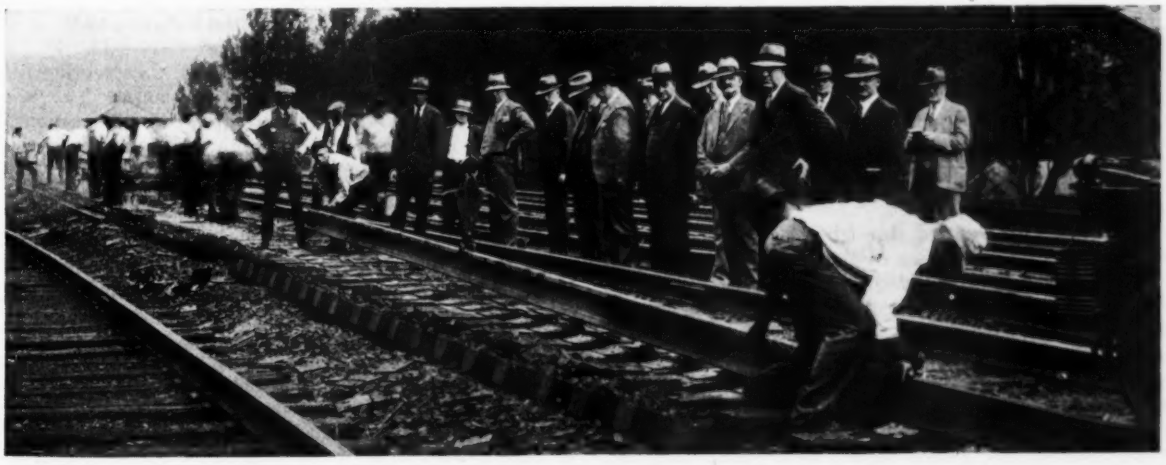
Work in tunnels up to about 2,000 ft. in length has, in many respects, been carried out by following methods similar to those described, all of the work being done by the use of pneumatic concrete placers and handled by separate gangs on each phase of the work. Regardless of the length of the tunnels being lined, the compressor equipment is always set up at one of the portals, stationary or car-mounted equipment being used depending upon the extent of the work and the air pressure required to transport the concrete. In the shorter tunnels, the concrete placers are also set up outside the tunnel to preclude the necessity of providing room for them inside. In certain of these tunnels also, because of the limited amount of work to be done, only one or two points of pouring are arranged and the gangs are reduced in size accordingly so that the men can be employed effectively in auxiliary work when not engaged in concrete pouring operations.

Cost Figures Vary Widely

As is to be expected the cost of the tunnel lining work on the Southern Pacific has fluctuated widely during the last 14 years, not only from year to year, but from tunnel to tunnel and, in some instances, throughout the length of a single tunnel. The varying factors which enter into the cost of the work include the cost of labor and materials at different times and points, the lengths of the tunnels and, to a greater extent, the length of sections authorized for lining in one continuous operation, the amount of tunnel enlarging, timber resetting and timber renewal required, the density of traffic and the familiarity of the men with the work.

Indicative of this fluctuating cost are the following cost figures taken from two lining jobs completed in recent years. In the case of one of these, which was a relatively short, single-track tunnel requiring extensive enlargement and retimbering, enlarging and retimbering work cost in the neighborhood of $80 per lin. ft., while the concrete lining and sills cost approximately $75 per lin. ft. In the case of the other single-track tunnel, which was considerably longer, but which required much less enlargement and retimbering, the cost of enlargement and retimbering was as low as $40 per ft. and the cost of the lining and concrete sills was as low as $62 per lin. ft. A general review of the costs of the various jobs completed to the present time indicates that under the varying conditions encountered, the cost of enlargement and retimbering has been from $60 to $80 per lin. ft. of single-track tunnel, and the cost of concreting from $55 to $75 per lin. ft. of tunnel, with an average total cost in the neighborhood of $135 per lin. ft.

All of the tunnel lining work on the Southern Pacific has been carried out by company forces with concrete placers leased on a royalty basis from the Ransome Concrete Machinery Company. Direct supervision over the work has been maintained by the various division engineers on whose territories the work has been done, while general direction of the work, since September, 1918, has been in the hands of W. H. Kirkbride, engineer maintenance of way and structures, assisted by Geo. W. Rear, bridge engineer.



Laying the First Stretch of 152-lb. Rail on the Pennsylvania, Near Birmingham, Pa.

C. B. & Q. Grows Trees for Snow Breaks

By H. L. FORD

Agricultural Development Agent, Chicago, Burlington & Quincy, Chicago

IN THE spring of 1928 the Chicago, Burlington & Quincy, in co-operation with the extension service of the Nebraska College of Agriculture and individual farmers, inaugurated a tree-planting program along the Burlington right-of-way in western Nebraska. A preliminary report of this project was presented in the September, 1928, issue of *Railway Engineering and Maintenance*, and since that date additional plantings have been made and the growth of the various species has been observed carefully.

(Above) Caraganas, Box Elder, American Elm, Chinese Elm and Jack Pines, Which Were Planted in April, 1928, and Photographed in August, 1929. (Below) The Same Planting in August, 1930

Nine plantings were made in April, 1928, using 7,150 trees. The majority of these trees made such an excellent growth in 1928 that 57 new plantings were made in 1929. Fifty additional plantings were made in the spring of 1930, using a total of 89,020 trees, and the territory was extended to include representative points on all divisions of the Burlington in Nebraska, Colorado and Wyoming.

How the Trees Are Obtained

All trees were secured through the extension service of the agricultural colleges of these states at a nominal cost which merely covered the handling charges of the extension departments. The trees were obtained under the same plan by which trees are sent to farmers throughout these states under an act of Congress which is designed to encourage the planting of trees in the plains area.

The planting stock included one-year-old American elm, Chinese elm, honey locust, box elder, caragana, Russian mulberry, Russian olive and green ash; two-year-old red cedar transplants and three-year-old Scotch pine, jack pine, Austrian pine, western yellow pine and limber pine. The plantings consist of from one to three rows. In cases of one row, a hedge variety has been used. In cases of more than one row, the two outside rows consist of hedge-growing varieties such as olive, mulberry or caragana. Replacements have been made wherever necessary. The heaviest losses have occurred in the evergreen stock and in some cases this stock has been a complete failure, while in several plantings the survival of this species is better than 95 per cent.

Purpose of the Project

The purpose of this project is to determine whether snow-fence protection can be secured adequately and economically through the use of trees, although the plantings were also designed as demonstrations to encourage farmers in the plains area to plant additional shelter belts and trees on their farmsteads. In connection with the project a definite program was undertaken for the proper preparation of the soil, the planting of the trees and their care subsequent to planting.

(Above) From Left to Right Caragana, Russian Olive and Chinese Elm, Which Were Planted in April, 1928, and Photographed in July of the Same Year. (Below) The Same Trees in August, 1930

As is illustrated by the accompanying illustrations, the growth of certain of the plantings has been such as to create effective snow-fences along the right-of-way wherever these plantings have been made. Moreover, these plantings have proved successful in demonstrating to farmers throughout this territory the possibility of establishing substantial shelter belts about their farm buildings by the use of properly adapted varieties of trees.

TEN YEARS AGO—President Harding and the administration are not seeking an immediate or general horizontal reduction in freight rates. The attitude of the President on the subject of rate reductions is now far more closely in accord with that of the railroad officers.—*Railway Age*, June 10, 1921.

This Question of Ballast*

A discussion of the properties and life of this important track material

By J. V. NEUBERT

Chief Engineer Maintenance of Way,
New York Central, New York

BALLAST is selected material placed on the roadbed for the purpose of holding the track in line and surface. Sub-ballast is any material of a superior character spread on the finished sub-grade of the roadbed to provide better drainage, to prevent upheaval by frost, and to distribute better the load over the roadbed. Top ballast is any material of a superior character spread over the sub-ballast to support the track structure, to distribute the load to the sub-ballast, and to provide good initial drainage. Foul ballast is ballast that has lost its porosity through the filling up of the voids by cinders, coal dust, disintegration of the ballast itself, dirt or other foreign material.

The following is a list of the various kinds of ballast in the order of their importance.

1. Stone, such as trap, limestone and hard sandstone.
2. Broken or crushed hard slag. Many feel this should come under Class 1.
3. Washed gravel.
4. Screened gravel.
5. Pit-run gravel.
6. Chatts, which are tailings from zinc, lead, silver, and other ore mines.
7. Burnt clay or gumbo.
8. Cinders.

The first four classifications come under the preferred group and are covered more or less by extensive specifications. The last four classifications, however, comprise pit-run material or that which is taken from natural deposits. In this discussion I will confine my remarks more or less to the preferred group. In order to serve the purpose for which it is intended, ballast must conform to the following requirements:

1. It must be hard enough to resist the crushing effect of the wheel loads that pass over the track.

2. It must be hard enough to resist the action of tamping tools.

3. It must be of such composition that it will not deteriorate due to weathering influences.

Soft ballast disintegrates rapidly and its deterioration becomes very pronounced when it is subjected to the shocks of wheel loads and tamping tools. Moreover, soft ballast absorbs moisture, which acts to retain the fine materials produced in manufacture, or the foreign materials resulting from railroad service. This causes the ballast to become sluggish, retards drainage, and causes a poor maintenance condition to develop rapidly.

In its report at the last convention of the American Railway Engineering Association, the Ballast committee proposed a revised specification for stone ballast, which was adopted as recommended practice and is to be printed in the Manual. This specification is very complete and fulfills all the requirements. In condensed form, the requirements of stone for ballast are as follows:

*An abstract of a paper presented before the Maintenance of Way Club of Chicago on April 23.

On the New York Central West of Dumont, N. J.

	Trap	*Limestone*
Specific gravity	2.81	2.68
Weight, cu. ft.	175 lb.	168 lb.
Toughness	15	10
Percentage of wear	3	5
Cementing value	1	4
Absorption	0.5	1.0

Stone ballast when manufactured should be as clean as possible and free from screening dust or other foreign material, since in order to give good service it must afford ample drainage from the start. In order to bring about such a condition, some railroad officers advocate the washing of the ballast prior to its application.

Ballast Should be Clean When Applied

If the ballast is not clean when first applied, the foreign material that collects through service adheres to it more readily and thus makes it more difficult to clean. This is particularly important now that steam locomotives are making longer runs and also because of the fact that automatic stokers using pulverized coal have been introduced, which result in the deposition of more dust and finer cinders on the roadbed than heretofore. The unloading of ballast from cars and the work of ballasting can be better regulated when clean ballast is used.

Ten or more years ago the question of cleaning stone or similar ballast in track periodically by setting up a definite schedule was not considered. This procedure has now been changed considerably and where ballast was formerly cleaned by hand once in six or more years,

depending on service conditions, it is now being cleaned by mechanical means and from one-half to one-third more frequently than heretofore. This policy prolongs the life of ballast, in addition to protecting and maintaining its drainage qualities. One can readily see, therefore, that ballast must be of such size and quality that it can be cleaned and used again as track ballast.

The question "What is the service life of stone ballast?" has been asked a number of times. I can find no records, nor have I any knowledge of any cases where the ballast section has been used to destruction. In fact it does not seem to me to be possible that ballast, such as that in the stone class, can be entirely destroyed under our operating conditions. Tests have been made to define service life, but as yet nothing definite has been determined. I believe one of the committees of the A. R. E. A. has had this under advisement for several years and is still studying it to see if some values can be reached.

Stone or similar ballast has been used on our lines for approximately 30 years. During this period some additional ballast has been applied, but largely in connection with the surfacing program. This additional stone was used to restore the consolidation of material as well as to increase the cross-section, and in some cases its purpose might have been to compensate for losses through the subgrade. The original stone, with the exception of slight deterioration from service, is as good now as when installed. Some cleaning in the top course has been found desirable and this work is now being carried out.

The loss of ballast resulting from cleaning, deterioration, and shrinkage due to the consolidation of material under traffic is in my opinion often erroneously taken as an indication of service life. The replacement of ballast to compensate for the losses just stated varies considerably, depending on service and roadbed conditions. The best estimate of replacement that I have been able to make is from 2½ to 3½ per cent annually, and this should be classified as replacement due to loss rather than as an indication of service life. The conservative life of gravel ballast is from 2 to 15 years, and that of cinder ballast is from 2 to 10 years, depending on service and local conditions.

Roadbed Should Be Prepared

Before considering the application of ballast, the roadbed section should be prepared to carry the cross-section of the ballast area, taking into full consideration the need of sufficient shoulder to protect the traffic, as well as to protect the ballast section. The roadbed should also have sufficient drainage to allow surface and other waters to be carried off along the right of way and be diverted from the roadbed area. In addition it should permit the drainage from the ballast section to be carried off quickly.

The proper depth of ballast is a question that has to be solved by the individual railroad. Until the roadbed on a newly constructed line has become thoroughly stabilized, I feel that gravel, cinders, burnt clay and other lighter kinds of ballast should be applied first. This aids and assists in the proper seasoning of the roadbed and in producing a uniform pressure on the subgrade.

The A. R. E. A. and the majority of the railroads whose ballast plans I have seen, recommend a sub-ballast of 12 in. and a top ballast of 12 in. under the tie. A combination of well-seasoned roadbed with a 12-in. sub-ballast and a top course of about 12 in. of what would be called a superior ballast, in my estimation, will give a much better track construction than the same amount of superior ballast when first applied.

On those lines with which I am familiar, where there has been a rapid increase in tonnage and where the ballast has become more or less worn out and the rail too light for the heavier traffic imposed. I am of the opinion that the installation of superior ballast should be made in advance of the rail program. This will produce a better railroad than by applying the heavier rail section first and following it with a superior ballast.

Many railroad officers have contended that by an increase of from 10 to 20 lb. per yard, in the weight of rail, they could overcome the inferiority of their present ballast section. They found, however, that it was more economical to apply some preferred ballast, such as stone, even though it necessitated proceeding on a slower rail installation program. There are no arguments against the fact that, if the earnings and the traffic permit, stone or similar ballast is superior to any. This type of ballast has longer life, provides quicker and better drainage, and can be worked from one to three months a year longer than lighter or finer ballast.

I feel that a railroad which has provided its roadbed and ballast section with good drainage has aided materially in prolonging the average life of ties and of rail, and in reducing track labor, as well as in giving a smoother riding track.

Picking Up Scrap Every Day*

IN VIEW of the large value in track scrap, supervision over it should start as soon as the scrap is removed from the track. The accumulation and sorting of scrap on the sections can be accomplished satisfactorily only by educating the foremen to gather and classify it each day. Insistence upon attention to scrap and to its regular clean-up and classification is the duty of the supervisor, and anything short of this is an indication of inefficiency and waste.

One large system in the West requires its foremen to pick up all scrap at the end of each day's work and to take it to the tool houses. Here the reusable material is sorted from the true scrap, the two classes of material being placed in separate bins on the side of the tool house opposite the motor car gasoline supply tank. When supplies and materials are issued from the supply train, this relative position of the scrap bins and the gasoline tank, with respect to the tool house, is such that one spotting of the train permits a magnet-equipped crane to pick up the scrap while tools and other supplies are being set off and while the gasoline supply is being replenished from the tank car in the supply train, without the different operations conflicting or interfering in any way with each other.

Some Scrap Separated

Foremen are required to separate brass from the general scrap and to keep it under lock and key in the tool houses. Wire and tin are also kept separate outside of the scrap bins because of the difficulty in handling this class of material with a magnet, along with iron and steel scrap. Scrap wire and tin are usually handled by a grab hook on the crane line. On this same road the supply train is run over the road every two months, subject to some modification if conditions warrant.

One large railway in the East, which takes pride in

*Abstract of a paper presented before the Metropolitan Track Supervisors' Club, by a committee of which A. E. Preble, supervisor on the Pennsylvania, at Pottsville, Pa., was chairman.

keeping its right-of-way neat and clean, has all scrap picked up and brought to the tool houses regularly, where it is deposited into bins constructed of old ties. These bins, which have three sides, 18 in. high, are approximately 5 ft. by 7 ft. inside. The side toward the track is left open to permit the use of shovels in handling the smaller scrap.

A 24-hr. Time Limit

Orders are issued on this road that all scrap, including brake beams, knuckles, brake shoes, drawbars, etc., must be taken to the section scrap bins within 24 hours of the time they are deposited on the right-of-way, except in the cases where parts are too large to be handled by hand, under which circumstances they are allowed to remain on the right-of-way until the first opportunity to pick them up by a work train. In rail laying jobs, it is required that old unused material be sorted into piles at intervals and that it be loaded by the work train when the old rail is picked up.

Each month the stores department of this road operates a supply train over the road, which delivers tools, small materials and supplies, and which, at the same time, picks up worn out and broken tools. As the scrap cars become filled, they are set off and billed to the storekeeper at the general storehouse. At the storehouse the scrap is unloaded by magnets and sorted for sale, reclamation, or other purposes. The section foremen keep in touch with the movement of the train and arrange to have several men on hand at their tool houses to load the scrap when the train arrives.

Practices Differ on Other Roads

Another large system in the East operates a joint scrap and supply train over its divisions each month, taking the place of a work train. The section forces pick up all scrap at the end of each day's work and take it to the tool houses. Here it is sorted and placed in scrap boxes so located that one spotting of the train will permit the delivering of supplies, the replacing of worn or defective tools, and the picking up of the scrap with a crane.

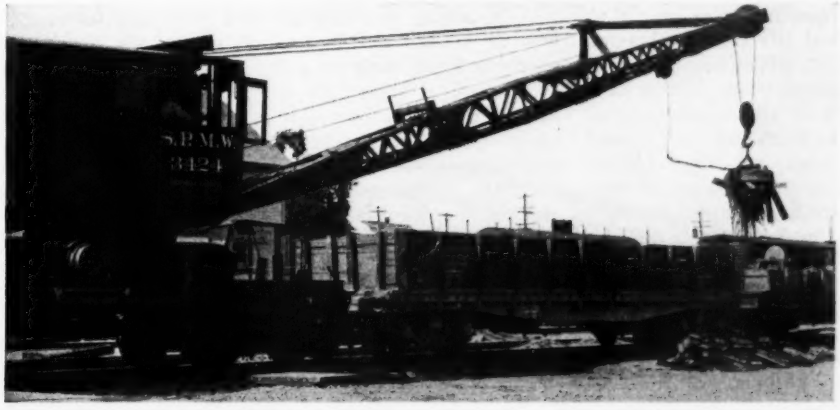
The scrap boxes provided have three sides and an open front, with a ring near the front of each side and one in the center of the back so that the boxes can be picked up by the snatch hook of a crane and dumped into the scrap car of the supply train. The crane on the supply train is located between a small scrap car and a scrap rail car, so that a clean-up can be made of all material as the train moves over the division.

When the scrap cars in the train are filled, they are set out and billed to scrap docks or reclamation plants. If not loaded to capacity, the cars are turned over or are shipped to the adjacent supervisor for maximum loading.

Certain other roads in the East and South also gather scrap at the end of each day's work and take it to the tool houses, where it is sorted into scrap bins. At regular intervals scrap cars are started at one end of each subdivision and are handled by local freight trains from station to station, where the contents of the scrap bins are picked up. When full, these cars are forwarded to a scrap dock where the scrap is sorted and disposed of on sales orders.

Many Roads Pick Up Scrap Every Day

On another large system in the East and Central West, on which it was formerly the practice for trackwalkers to collect the scrap into small piles along the right-of-way, trackwalkers have been dispensed with and scrap is now brought to the tool houses and loaded into scrap cars carried by supply trains which cover the divisions once every five weeks.



On the Southern Pacific Each Section Is Served at 60-day Intervals by a Supply Train Equipped with a Crane for Picking Up and Loading All Scrap

Out of 11 large systems, covering all sections of the country, which answered a questionnaire concerning their practice in the handling of scrap, six stated that scrap is picked up and taken to the tool houses at the end of each day's work. The other five made no special mention as to whether the scrap was picked up daily or weekly. All of the roads reported that they take scrap to the tool houses, but there was a considerable difference in the practice of disposing of the scrap at these points. Five stated that the scrap was loaded into the cars of local freight trains; five reported the use of combination scrap and supply trains; and one, that its scrap was picked up by a work train.

Conclusions

In conclusion, the committee makes the three following recommendations:

First—That all track scrap be gathered, taken to the tool house and sorted at the end of each day's work.

Second—That a joint supply and scrap train be scheduled over each division monthly, or that scrap cars be started at one end of each division and be handled over the divisions by local freight trains as may best meet the needs of each division.

Third—That insistence be placed on a clean and neat right-of-way to prevent personal injuries, to secure favorable reaction from the public, and to insure the highest values for scrap at scrap docks.

Finding New Applications For Treated Timber

How one railway has extended the use of this material to include a wide variety of adaptations

By R. S. BELCHER

Manager, Treating Plants, Atchison, Topeka & Santa Fe, Topeka, Kan.

[For many years the Atchison, Topeka & Santa Fe has consistently held a position in the front rank among the railways of the country in the use of treated timber. The maintenance of way officers of this road have not considered it sufficient, however, merely to give the timber preservative treatment. They have constantly studied the conditions and methods of use and have sought to develop means whereby additional life can be obtained from treated material beyond that which might reasonably be expected from the treatment alone. They have kept records of the performance of all treated material that they have applied and of the causes of failure, and have sought to eliminate or minimize the latter. Many tests have been made to determine the character of timber and type of treatment that are best adapted for each of the widely divergent physical and climatic conditions which are encountered on the lines of this system. Not the least interesting phase of these economic studies is the steady effort that is being made to extend the use of treated material to include new applications that are considered practicable and economical. In the following abstract of a paper which was presented before the American Wood Preservers' Association at its convention in Philadelphia, Pa., on January 28, Mr. Belcher tells of the wide diversity of uses which this road is making of treated timber.—EDITOR.]

THE first treated wood used by the Atchison, Topeka & Santa Fe was creosoted piling, treated at a plant at Galveston, Tex., in 1875 for use in the construction of the Bay bridge into Galveston. Our first crossties were treated at Las Vegas, N. M., in 1885, but it was not until 10 years later that we began to treat lumber and piling for inland use. From that time, the amount of lumber and piling treated has increased steadily until, in 1930, more than 19 million board feet of lumber and 895,000 lin. ft. of piling went through our plants. Also, in 1930, upwards of 425,000 cu. ft. of miscellaneous material was treated. While these figures may seem large, yet the lumber, piling and miscellaneous timber amounted to only 15 per cent of the total amount of timber treated during the year, the remaining 85 per cent being cross and switch ties. Since 1895, more than 27 million cubic feet of lumber, 14 million lineal feet of piling and 4 million cubic feet of miscellaneous material have been treated and put into service on this road.

During the past five years, the signal department of this road has used an average of approximately 588,000 bd. ft. a year of 2-in. by 6-in. and 3-in. by 6-in. treated trunking and 1-in. by 6-in. treated capping. Since 1923, when the treatment of trunking was started, 3,800,000 ft. b. m. has been turned out at Santa Fe plants. This material is given an 8-lb. Rueping creosote treatment and usually is seasoned two months or more after treatment before it is put in service, to insure a dry surface. The signal wires are "pitched in" and there has been no complaint of oily trunking or damage to wire insulation from the creosote.

All trunking and capping have been manufactured as well as treated at the treating plants, the sizing and grooving being done on a timber sizer at one operation by the use of special knives. The lumber is purchased in sizes of 1½ in. by 6½ in., 2½ in. by 6½ in. and 3½ in. by 6½ in. in the rough and after four to six months' seasoning is worked to finished sizes and then treated.

At the request of the signal department, we are now starting the manufacture of a molding which is to be used for the protection of switch wiring. This is manufactured in the same manner as the trunking, and in use is nailed to the sides of switch ties. In the past, there has been some trouble because of broken wires caused by ice forming in the galvanized conduit formerly used for this purpose, and it is thought that the use of the treated molding will overcome this trouble.

Treated gum blocks are used to protect switch rods. They are also manufactured at the treating plants and are given an 8-lb. treatment of 50-50 creosote-petroleum mixture.

Material Treated for the A. T. & S. F.

Kind of Material	Pieces, board feet or lineal feet	Cubic feet	Per cent
1885 to 1930, Inclusive			
Crossties	98,817,620 pcs.	317,766,846	85
Switch ties	123,120,370 bd. ft.	10,272,275	3
Lumber	330,134,198 bd. ft.	27,506,555	7
Piling	14,699,139 lin. ft.	13,903,546	4
Miscellaneous		4,029,190	1
Total		373,478,412	100
1930			
Crossties	5,099,134 pcs.	15,730,469	82
Switch ties	8,214,743 bd. ft.	684,580	3
Lumber	19,689,360 bd. ft.	1,641,154	9
Piling	895,151 lin. ft.	811,572	4
Miscellaneous		424,524	2
Total		19,292,299	100

Poles and Pole Stubs

In addition to these special items, the treating plants furnish the signal department with creosoted Southern pine poles, which are given an 8-lb. Rueping creosote treatment. They are roofed, gained and bored at the plants before treatment. Signal pole stubs receive the same treatment as the poles. These are 10 ft. long with tops not less than 8 in. nor more than 10 in. in diameter, bored for two ¾-in. bolts and roofed at a 45-deg. angle.

In addition to the bolts, wire is used to bind them to the pole which they are to reinforce. These stubs are also bored and roofed at the plants. The poles that are thus reinforced are untreated. During the last five years an average of 90,870 lin. ft. of poles and 18,280 lin. ft. of stubs, or 2,000 pieces, have been turned out by our plants each year. The poles range in length from 30 ft. to 40 ft., although both shorter and longer lengths are often required. All poles for telegraph lines are furnished by the Western Union Telegraph Company, and these are also creosoted Southern pine.

Fence Posts

The posts most commonly used in our right of way fences are round treated pine. The specifications call for posts 7 ft. long with 3½ to 5-in. tops. Corner, gate and brace posts are 8 ft. long with a minimum top diameter of 6 in. and a maximum of 9 in., and the gate posts are braced with treated braces 4 in. by 4 in. by 12 ft. At cattle guards, the wing fences are supported by treated posts 6 in. by 6 in. by 9 ft. 6 in. and 6 in. by 6 in. by 4 ft. 6 in.

All posts used in standard stock yards are treated. Two lengths of round posts are used, 9 ft. for the outside fences and 8 ft. for the interior fences which divide the stock yards into pens. Both the 8-ft. and 9-ft. posts have 7 to 9-in. top diameters. They have a slab 3 to 4 in. wide taken off with a broad axe on one side, commencing at the small end and extending to within 3 ft. of the large end. They are given an 8-lb., 50-50 creosote-petroleum-mixture treatment. Six inch by 8-in. and 8-in. by 8-in. creosoted pine are used for the long posts to support the stock yard chutes. The platform at the end of the chute may be supported by treated pile heads resting on footings of three pieces of 2-in. by 12-in. by 2-ft., two pieces laid side by side and the third at right angles and on top of the first two. This type of footing is also commonly used with pile heads under cotton platforms and other structures of like character.

An average of 153,000 seven-foot posts have been treated at Santa Fe plants annually during the last five years, in addition to 7,500 eight-foot corner posts. Likewise, an average of 2,548 stock-yard posts have been treated each year. While treated pine posts have been standard since 1918, extensive tests have been made of steel posts. On the Coast lines, it is the practice to split redwood ties that have failed because of plate cutting, spike killing, etc., and use them as fence posts. The pine right of way posts are made from saplings and are given a 5-lb., 50-50 creosote-petroleum treatment.

Unless one has furnished or placed signs, or has been more than ordinarily observing, he will be surprised at the large number of signs used along a railroad right of way. On the Santa Fe, some of these signs are of all-metal construction, some are metal signs attached to treated posts, and a large number are wooden signs and posts spliced to treated timber bases. The framing and boring of the treated posts and bases is done at the treating plants. The treated material is painted with a mineral brown paint after it has weathered sufficiently to permit the paint to adhere.

Plank for Highway Crossings

The old type of untreated planked road crossing is fast disappearing, and cut-to-fit treated plank laid on furring strips is taking its place. On the Santa Fe, cut-to-fit treated crossings are furnished ready to put down by the section or bridge men with a minimum of labor in the field. The planks are 4 in. thick for all section of rail, but the thickness of the furring is varied to suit the rail sections with which it is to be used. All milling, which includes sizing, grooving the planks next to the rails for wheel flangeways, beveling the ends of the furring to fit rail flanges, notching the ends of the furring for the spike heads and beveling the ends of the plank, is done at the treating plants. The lumber is purchased in the rough and seasoned before milling.

Dean Lake Trestle After 32 Years of Service

The planks bear numbers corresponding with numbers on the plans, to aid those making the installation. Important road crossings are fully planked. Unimportant crossings and private crossings require only one plank on each side of the rail, the space being filled with ballast. The planks are 8 and 10 in. wide. Furring strips are fastened with 20d spikes and the planks with ⅜-in. by 8-in. or ⅜-in. by 10-in. boat spikes.

Crossings are furnished in any required lengths but usually in multiples of eight feet. Special crossings are frequently ordered according to sketches furnished with the orders, where the streets cross the track at a turnout, etc.

Treated black gum is used for all crossings east of Clovis, N. M., and Dodge City, Kan. Between these points and Albuquerque, N. M., treated black gum is used for important crossings and treated Western yellow pine for unimportant crossings. In the territory between Albuquerque and Williams, Ariz., treated black

gum is used for important crossings and treated Western yellow pine or treated Douglas fir is used for unimportant crossings. West of Williams, treated black gum, treated Douglas fir or untreated Port Orford cedar is optional for important crossings, depending upon the character of the crossing, and treated Douglas fir is used for unimportant crossings.

During 1930, the Somerville treating plant produced 2,081,127 ft. b. m. of black gum crossing plank and furring which was given an 8-lb. Reuping treatment of

Effect of Exposing Untreated Surfaces in Treated Timber

50-50 creosote-petroleum mixture. All of the black gum timber is furnished from this plant, owing to its location near the source of supply. A principal advantage of black gum for this use is the fact that it has an interlaced grain, does not split readily and presents a tough, long-wearing surface, so that twice the life should be obtained from this wood that is given by yellow pine on heavy traffic crossings.

Wood Block Floors

There is nothing particularly new about the use of treated wood block floors but they constitute one of the important uses of creosoted wood. On the Santa Fe, creosoted blocks have been used for machine shop floors in many locations and have given excellent results. Since 1920, approximately 72,000 sq. yd. of creosoted wood blocks have been used by this road, of which 62,000 sq. yd. was for inside flooring and the remainder for outside use, principally on platforms.

All timbers for 150-ton and 100-ton track scales and 10-ton stock scales are now preframed, prebored and treated. The scale department reports that cut-to-fit scale timbers are more convenient and economical to install.

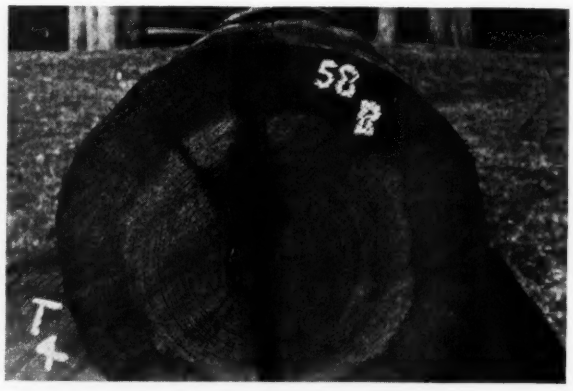
There is an increasing call for treated lumber which can be painted. In this connection, an experiment made at the Somerville treating plant may be of interest. In constructing the office at this plant in 1917, the lath and the material used for making the lattice panels which hide the treated pile-head foundation, were treated with zinc chloride, dried and then made into the panels. The latter have been painted every time the building has been painted during the 13 years that they have been in service, and paint wears as well on this material as on the untreated weather-boarding. None of this latticework has been renewed and it is still in excellent condition.

Bridge Timbers and Drain Boxes

The greater part of the 19,689,360 bd. ft. of lumber treated during 1930 at the Santa Fe plants—in fact, the greater part of the lumber treated every year since we began to treat lumber—has been used in timber bridges and wooden drain boxes. This is probably true on other roads using treated lumber, and there is nothing new in the use of treated lumber in bridges and box culverts. The boxes are made in sizes, single and double, ranging from 1 ft. by 1 ft. 6 in. to 4 ft. by 3 ft. The smaller boxes have 3-in. by 12-in. side walls, placed on edge. Larger boxes have walls made of 2-in. by 4-in. or 3-in. by 8-in. material laid flat.

All drain box covers, bottoms, side-wall braces, etc., are cut to length at the treating plants to avoid cutting in the field and the resulting decay of exposed untreated wood, which was experienced in drain box construction of former years. Many instances have come to attention which indicate how necessary it is to protect the untreated ends of timbers when cut after treatment. Better and more uniform results are obtained, however, when all parts of a treated structure are cut to length, machined, bored, etc., before treatment. Creosoted drain boxes were first used on the Santa Fe in 1906, untreated redwood, cypress and cedar having been used prior to that date. In 1930, our treating plants furnished a total of 2,209,000 ft. b. m. of material for this purpose.

For several years, the bridge men on the Santa Fe have accomplished splendid results in the construction of timber bridges without sawing treated material to length in the field. In one case, a ballast-deck pile trestle of 65 bents was constructed with the cutting of only eight timbers, all of which were sway braces, and the ends were well treated with hot creosote and hot sealing compound after cutting. On another division, 2,618 ft. of ballast-deck bridges were constructed in one year without cutting a single piece of treated timber in the



Result of Untreated Bolt Holes in Treated Piles

field, other than the piles at the cap line. It is our practice to treat bolt holes with creosote and sealing compound, although the exact method of doing this has not as yet been made standard. Holes bored in piling for sway-brace bolts were all treated with hot creosote by plugging the holes on one side of the piling and screwing a ¾-in. wrought iron nipple with an ell on it, in the other side of the piling, filling with hot creosote and leaving until all the creosote has soaked into the wood.

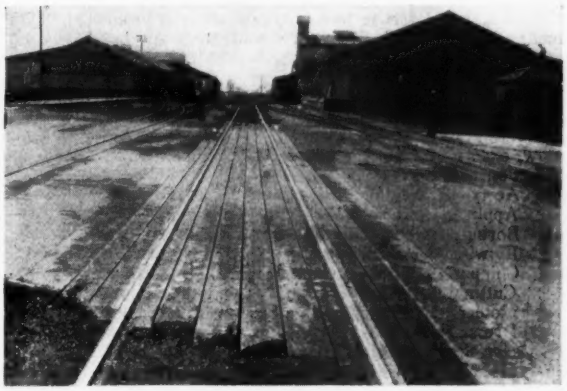
New Line Construction

An example of the many applications of treated timber by this road is found in the construction of the Clinton & Oklahoma Western, a subsidiary line between Pampa, Tex., and Cheyenne, Okla., 81 miles, which was built in 1928 and 1929 to provide a connecting link between Santa Fe lines and the Kansas City, Mexico & Orient, now a part of the Santa Fe system.

Creosoted wood-box culverts were used in all embank-

ments not exceeding 13 ft. high, more than 780,000 ft. b. m. of treated lumber being required for this purpose. In general, pile trestles were of the ballast-deck type, with six piles to the bent. Creosoted material was used throughout, the requirements being 110,000 lin. ft. of piling, 130,000 ft. b. m. for caps, 710,000 ft. b. m. for stringers and 370,000 ft. b. m. of other timbers, or a total of 1,210,000 ft. b. m. About 300,000 crossties and 200,000 ft. b. m. of switch ties, all of which were creosoted, were used for laying the tracks and turnouts.

Grade crossings were eliminated at important highways, and elsewhere where practicable. Creosoted black gum planking was used at all crossings remaining at



A Crossing of Treated Black Gum

grade, 62,000 ft. b. m. being required in this application. For fencing the right of way, creosoted posts and braces were used, the requirements for this work being 52,000 fence posts and 40,000 ft. b. m. for bracing.

In constructing station and other buildings, creosoted material was used wherever practicable to do so. The foundations consisted, generally, of creosoted pile heads, while sills and girders, posts and lumber in stock yards, curbs for platforms and other timbers in contact with the ground were all of creosoted material.

Bridge Plans Revised

For some time past, we have been revising the plans for open-deck and ballast-deck treated timber trestle bridges. In these plans, every precaution is being taken to design the bridges so that practically every piece of treated timber may be sized and cut to length before treatment and even to provide for the preboring of a large percentage of the bolt holes. Certain of the notes which appear on these plans are of sufficient interest to warrant repeating as follows:

All timber and piles shall be given a preservative treatment.

All timber shall be cut to exact length, surfaced and prebored as required, at the treating plant before treatment is applied.

To justify the construction of timber bridges, a long life must be obtained and maintenance costs must be slight; consequently, extreme care should be exercised in the handling and placing of treated timber or piles.

The damaging of the surface of treated timber or piles by the unnecessary use of timber hooks, peevies, etc., should be avoided. When possible, treated timber or piles should be handled by rope slings. The dropping of treated timber or piles from an excessive height should be discouraged.

When it becomes necessary to work from scaffolds in constructing a bridge, such scaffolding should be hung by ropes and not nailed to the treated timber or piles.

When necessary to bore holes in treated timber or piles in the field, such holes shall be well swabbed with hot preservative, followed by the sealing compound applied hot, and the bolt must be driven home immediately. All bolts are to be cleaned of all rust and scale, and dipped in hot sealing compound, just before being driven. All unused holes, either prebored or bored in the field, are to be fitted with round creosoted plugs. These plugs to be dipped in hot sealing compound before being driven.

Tops of piles are to be treated with hot preservatives, followed by two coats of hot sealing compound, and then covered with a sheet of approved two-ply Rubberoid or similar material. Before placing the cap, a liberal quantity of luke-warm sealing compound shall be poured on the sheet and spread over the area to be covered by the cap.

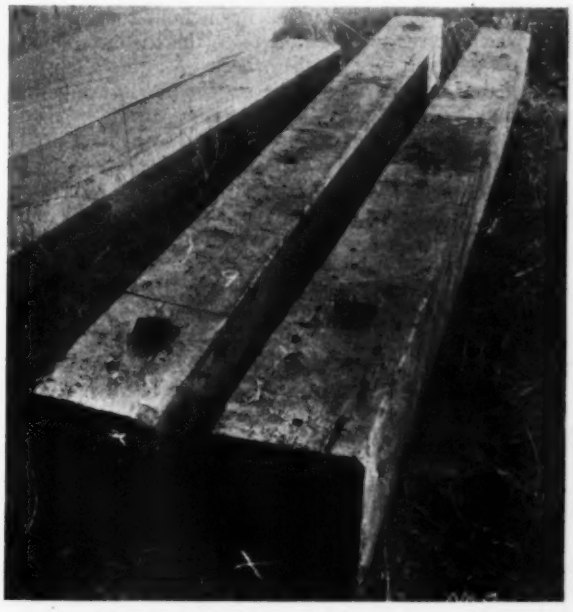
All material except that for longitudinal bracing shall be ordered from standard bills of material. Material for longitudinal bracing to be ordered as conditions may require.

All bridge gangs must keep on hand a supply of creosoted fillers in the following sizes: 1 in. by 10 in. by 2 ft., 2 in. by 10 in. by 2 ft., 3 in. by 10 in. by 2 ft., 4 in. by 10 in. by 2 ft. These are to be used as may be required if necessary to fur out on caps or piles.

A liberal supply of creosoted plugs is to be kept on hand at all times. These plugs are to be furnished by the treating plants.

Sway-brace and sash-brace bolts are to be ordered in lengths ranging from 20 in. to 26 in. as the actual length depends upon the diameter of the pile.

The sealing compound is a mixture of creosote and coal-tar pitch, approximately 20 per cent of the former to 80 per cent of the latter. It is heated and applied hot, except as noted for the application to the roofing for the protection of the cap, in which case it is to be only luke-warm. The bridge plugs are the same size as the bolt holes. They make a snug but not too tight a fit. The proper use of treated bridge plugs is but one of the



These Treated Caps Are Sound After 25 Years of Service

items of good workmanship in the construction or repair of treated timber bridges. Most important of all, perhaps, except proper treatment of the wood, is the use of presized, prebored and preframed treated timbers and the careful protection of cut-offs, bored holes, etc., where preframing, preboring, etc., is not possible.

FIFTY YEARS AGO.—The Northern Pacific transcontinental line is to be completed in less than three years. The Union Pacific line to the Pacific Coast in Oregon will probably be finished before that, and the Atlantic & Pacific on the Thirty-second parallel is being pushed at a rate indicating that it will not be much behind. We will doubtless have five railways across the continent in less than five years.—*Railway Age*, June 16, 1881.

Pennsylvania Puts Force Behind Its Safety Rules

Issues detailed instructions in pamphlet form to all employees and makes observance mandatory

THE Pennsylvania no longer allows cause for doubt as to what its safety rules are or to whom they apply. Of still greater significance, it has largely set aside past efforts toward moral suasion and now makes observance of the rules, and checking to see that they are observed, mandatory. All of the safety rules of the Pennsylvania are now issued in regular pocket-manual form, supplementing the road's standard code of rules for the operation of trains and the conduct of employees.

The outstanding features of the Pennsylvania's action, in addition to the fact that the safety rules of the road are now made available to employees as constant reference and reminder, are the completeness of the rules and the thought that is carried throughout the compilation, which leaves no question as to the distinct obligation on each employee to obey the rules himself, and to see that they are obeyed by others. The new rules, which were made effective on October 1, 1929, cover the principal causes of injuries to employees shown in the bulletins of the Interstate Commerce Commission, and, in addition, include the detailed causes of non-train accidents which do not appear in the bulletins.

Rule after rule is in the form of an order, while many other rules end with the words, "is prohibited." A statement in the second page of the published rules, over the signature of the general manager, makes it clear that all employees to whom the rules apply will be furnished with a copy of the rules and that they are required to understand and obey them.

The new rule book is divided into four main sections for train and engine service employees, for station employees, for maintenance of way and structures employees, and for maintenance of equipment and stores employees. Rule A of each of the four sections reads as follows: "Carelessness is prohibited." On a prefatory page in each book are definitions of safety, care, careless, carelessness and discipline taken from Webster's dictionary.

A composite book containing the rules for all departments is provided for the use of officers, their assistants, safety agents and others who are required to know the rules for all departments and to see that they are obeyed. In addition, each section of the book is issued in pamphlet form by itself for distribution to the employees of the different departments.

Maintenance of Way and Structures Employees

There are 97 safety rules prescribed for the conduct of maintenance of way employees, which are listed in order in the following:

Rule A. Carelessness is prohibited.

3001. Stowing material or tools in safety manholes in tunnels or in manholes of telegraph and telephone lines is prohibited.

3002. Sitting, lying or crossing under cars for protection or convenience is prohibited.

3003. Using defective tools and appliances is prohibited. They must be kept separated from serviceable tools and appliances and repaired or reported to the proper person for repairs.

3004. Standing within the swing of tools in the hands of workmen or in front of rivets or bolts being chiseled off is prohibited.

3005. Wear prescribed goggles when performing work listed below, except where other guards are provided which afford full protection to the eyes:

a. Acetylene welding and cutting.
b. Applying or removing chemical paint remover.
c. Boring, drilling or reaming overhead.
d. Blowing out generators, motors and flues.
e. Chipping, cutting or caulking metal, stone or concrete.
f. Cutting off rivet or bolt heads and splitting nuts.
g. Holder and sledger cutting rail and track bolts.
h. Dressing emery wheels and grindstones.
i. Dressing with dry emery wheels.
j. Holding and sledging handle cutter and handle punch on cold metal.
k. Holding and sledging bar chisel and punch on cold metal.
n. Pouring molten metal and acids.
o. Riveting and heating rivets.
p. Scaling and scraping.
r. Turning wood on lathe.
s. Using air tools. (Except tamping ties.)
t. All other industrial operations hazardous to the eyes. (To be determined by foreman in charge.)

3006. Persons not engaged in operations listed above are prohibited from facing them.

3007. Rubbing the face with ones hands while handling creosoted ties, lumber, etc., is prohibited.

3008. Walking or stepping on rails, frogs, switches, guard rails, interlocking machinery or connections, except when necessary, is prohibited.

3009. Walking, standing or sitting on tracks, except when necessary for the proper performance of duty, is prohibited.

3010. Stand clear of swinging or lifted loads.

3011. Before crossing tracks look in both directions for approaching trains, locomotives or cars. Crossing tracks immediately in front of moving trains, locomotives or cars is prohibited.

3012. Fill or protect holes about the track before dark. Protect manholes when open and cover immediately after work is finished.

3013. Place track jacks on the outside of the rail when practicable. When not practicable, protect by flag.

3014. Watchmen, patrolmen, track walkers and others on duty which makes it necessary for them to be on the tracks, where there are two or more tracks, shall travel against the current of traffic, keeping a sharp look-out in both directions for approaching trains. In case of fog, snow storm or other weather conditions obscuring the view, they shall move to a place of safety, preferably clear of all tracks, when a train is approaching.

3015. Remove boards with nails protruding and other refuse material promptly.

3016. Use authorized paths in going to and from work.

3017. Keep at least 10 ft. away from standing trains, locomotives or cars when crossing tracks, when possible to do so.

3018. Take hold and let go in unison when handling material.

3019. On the approach of a train, employees who are working on or about the tracks shall, where conditions make it necessary, move to a place of safety, preferably clear of all tracks. If not clear of all tracks, they must discontinue work and exercise care to avoid being "trapped" by trains on adjacent tracks.

3020. When large numbers of inexperienced men are working on the tracks, divide them into small squads and place an experienced man in charge of each squad.

3021. All members of a gang should clear on the same side of the track with the foreman or a person designated by the foreman.

3022. Place and pile material in a safe and orderly manner a safe distance from the track.
3023. Use broom, bagging or similar material when cutting off bolt heads, rivets, etc.
3024. Use a screen to prevent material flying when cutting scrap by power.
3025. Request unauthorized persons not to trespass on company property.
3026. Use a sledge to strike cutting and backing out tools and lining pins. The use of a spike maul for this purpose is prohibited.
3027. Use care to avoid accident from—
a. Ties, timber, rails and other material falling on the hands and feet when lifting, handling, loading or unloading by hand or with unloader, derrick, etc.
b. Falling off and being run over by hand cars, track cars, trucks and trailers.
c. Tools or material shifting or falling off hand cars, track cars, trucks and trailers.
d. Use of jacks or spike puller.
e. Spikes or spike heads flying up.
f. Tools in the hands of fellow workmen.
g. Sledges or other tools glancing.
h. Being cut by adze or other edged tools.
i. Spawls flying off hammers, sledges, bolt heads, etc.
j. Dirt or stones flying up when tamping ties.
k. Splinters or nails in hands or feet.
l. Slipping, tripping or falling.
m. Tools slipping and striking or falling on hands or feet.
3028. Using umbrellas, and wearing ear coverings which interfere with the hearing, while on or about tracks, is prohibited.
3029. Foremen, watchmen and others in charge of men engaged in work on or about the tracks must provide themselves with a whistle, which must always be used to warn men of approaching trains.
3030. Store all tools so that they will be secure; heavy tools on the floor, sharp edged tools in bins or racks.
3031. Use care to avoid coming in contact with high voltage wires.
3032. Use rubber gloves, dry sticks or boards, or other non-conductors of electricity when it becomes necessary to remove broken or dangling wires or to remove objects from third rail or overhead wires.
3033. When approaching trains cannot readily be seen because of weather conditions or obstructions, extra precautions must be taken.
3034. When it is necessary to place watchmen some distance from men, or in such locations that signals may not be understood, additional watchmen should be placed so that signals can be passed to the men and return signals obtained. If return signals are not received and understood, the watchman must signal a train to stop.
3035. When working on tracks adjacent to track fences, remove such panels of fences as will insure safety of men.
3036. Employees working in a tunnel, on the approach of trains, must occupy manholes.
3037. In tunnels where the clearance is limited and no manholes or other places of safety are provided, a foreman must arrange with the superintendent for the use of track and work under flag protection.
3038. In tunnels where mechanical draft is installed to remove gases, workmen, except in emergency, are prohibited in the tunnel unless draft machinery is in operation.
3039. Working in tunnels without an adequate number of lights is prohibited.
3040. The use of cross-grained or other unsuitable material for scaffolds is prohibited.
3041. Working under other workmen where tools or material are likely to fall is prohibited.
3042. Use a safety rope or belt when working outside of windows, on steep pitched roofs, when unloading coal from drop bottom cars and when working on poles.
3043. Hanging ones legs over the side of a car is prohibited.
3044. Riding on cranes or ditchers or cars on which these machines are mounted, without permission of the operator, is prohibited.
3045. Throwing tools or material from cars, without knowing it is safe to do so, is prohibited.
3046. Scuffling or horse play is prohibited.
3047. Smoking or the use of open flames in or near manholes where gas may be present is prohibited.
3048. Leaving sharp tools stuck in poles is prohibited.
3049. Going up any pole before the climber has determined that it is safe to climb is prohibited.
3050. Handling live wires or messenger when an electrical storm is approaching is prohibited, except in emergency.
3051. Working on electric power lines while they are energized with voltages of 440 or more is prohibited, except in extreme emergency, and then it must be authorized by the foreman.
3052. Working on any energized electric power line without the use of rubber gloves is prohibited.
3053. Measuring the height of wires and poles with wire or wet rope, steel tape line or rope, or linen tape line containing metallic reinforcement, is prohibited.
3054. The use of safety straps to ride messenger is prohibited.
3055. Fasten a wire or cable before cutting to prevent the end from flying back.

Operating Track Cars, Hand Cars and Trucks

In addition to Rule 80, General Regulation 829 and Timetable instructions, the following rules will apply to employees operating track, hand or push cars.
3101. Riding on track cars without authority is prohibited.
3102. Operating track cars between a platform and a train discharging passengers at a station is prohibited.
3103. Attaching a track car to a locomotive, car or train is prohibited.
3104. Towing or pushing hand cars by track cars is prohibited.
3105. Riding upon a car being pushed is prohibited.
3106. Getting on or off moving track cars, hand cars or trucks, except when necessary, is prohibited. Getting on or off moving track cars, hand cars or trucks from the front end is prohibited.
3107. Leaving cars so that they obstruct traffic on public crossings is prohibited.
3108. The operation of defective track cars is prohibited.
3109. Smoking or using an open flame where gasoline tanks are being filled or gasoline is being handled is prohibited.
3110. Interfering with the driver of a car is prohibited.
3111. Filling the gasoline tank while the engine is running is prohibited.
3112. Proceeding over public highway crossings protected by gates before the gates are lowered, or, over crossings protected by watchmen, before a stop signal for highway traffic is displayed by the watchmen, is prohibited.
3113. Standing while riding on cars other than hand cars is prohibited.
3114. Coupling trailers or push cars, not provided with a rigid form of connection, to a track car, is prohibited.
3115. Place material, tools and supplies on cars so that they will not fall off or project over the sides. Distribute the load uniformly over the car. Lining bars or other bars must be placed in the bottom of the tool trough. Tools must be laid flat and pike poles with their points to the rear.
3116. Track motor and hand cars must be thoroughly inspected daily before being used to insure that all bolts, nuts and cotters are in place and tight; that gasoline tank, feed pipes and connections do not leak; that brakes are in good condition and adjustment; and that the wheel gage is correct. They must be kept in good order, and bearings and machinery well oiled.
3117. Before starting, there should be a thorough understanding as to what part each person is to take in handling the car should an emergency arise necessitating prompt moving of the car from the track.
3118. Drivers must test brakes immediately after starting cars.
3119. Retard spark fully before starting free-running motors.
3120. Start free-running motors by giving the crank a quarter turn, lifting on the crank with the fingers and thumb on the same side of the handle and keeping the body as far away as possible. Springing or moving the crank by downward pressure when starting the motor is prohibited.
3121. Keep motors in gear while descending steep grades.
3122. When starting direct-connected track cars, push from the rear and not from the side.
3123. Use the safety rail and handholds while riding on cars to avoid falling.
3124. Using kerosene as an anti-freeze solution in radiators is prohibited.
3125. Sitting on the front of a trailer car with the feet hanging over is prohibited.
3126. Touching the friction drive or belt, unless ignition is cut off, is prohibited.
3127. Starting the motor of a track car or allowing it to run while within the tool or car house is prohibited.
3128. Watch for stones or other obstructions in the flangeways of public or private highway crossings.
3129. Lock track cars when they are not under the immediate view of employees.
3130. The application of unapproved devices to track cars is prohibited.
3131. Keep a sharp lookout and control the speed of the car at interlockings and other points where switches are operated by remote control so that a stop can be made to avoid accident due to a conflicting route being unexpectedly set up.

Handling Gases and Gas Cylinders

6001. Throwing, dropping or otherwise roughly handling loaded or empty gas cylinders is prohibited.
6002. Allowing gas cylinder to stand near furnaces, steam pipes or other sources of heat is prohibited.
6003. Lifting or transporting gas cylinders by a crane, derrick or hoist is prohibited.
6004. Close the valves of gas cylinders not in use.
6005. Using leaking gas cylinders is prohibited. Remove leaking cylinders to the open air, clear of inflammable material or anything that will cause gas to ignite.
6006. Using open flames or smoking in gas storage buildings is prohibited.
6007. Using leaking hose or connections on gas cylinders is prohibited.
6008. Removing valve keys from acetylene cylinders while in use is prohibited.
6009. Changing or adjusting the pressure on regulators with torch valves closed is prohibited.
6010. Operating gas welding or cutting torches at pressures in excess of the prescribed maximum is prohibited.

Wholesale Distribution of Ties Reduces Cost

AS A RESULT of studies made to determine the most economical practices in maintenance, the Southern Pacific lines in Texas and Louisiana have, so far this year, distributed more than 200,000 crossties from solid trains of tie cars. These trains were made up of from 50 to 70 loaded flat cars, each containing about 500 ties. The 70-car trains have carried as many as 38,000 creosoted ties, sufficient to cover the tie requirements on 250 miles of track, and have required three working days to unload. As compared with the former method of unloading with local trains, the system followed this year has demonstrated a saving of $15,000, or 7½ cents a tie.

For a number of years it has been the practice on this road to load all ties for distribution on flat cars at the Houston, Tex., treating plant. It was customary to use from 16 to 20 hardwood stakes to the car and bind the load securely with wire, so that it would be safe for movement in regular trains. The cars were then billed to various stations, as required by the distribution schedules which were furnished by the divisions.

Loss of Productive Time

After the ties reached their destination they were generally unloaded from local freight trains. In some instances it was necessary to hold the cars under load for several days before a train was available to handle the cars for unloading. In other cases it was necessary to unload the ties at the stations and distribute them by means of track motor cars and trailers. In any event, considerable productive time was lost by the section forces in meeting the trains, and this was increased if the train was late or could not do the work. Furthermore, it was necessary for many of the trains to run up overtime in order to do the work at all.

For this reason, it was decided to try out a plan of specially assigned work trains for distributing the ties. Fortunately it had been possible to accumulate enough ties in storage at the plant to make the plan feasible on a large scale. There was also an advantage in the fact that Houston is the center from which a number of divisions radiate, thus making it a convenient point from which to make the distribution.

As a preliminary, the ties were loaded crosswise of the flat cars which were used in this service, by means of locomotive cranes working from the storage piles. Two iron standards were set up at each end of the cars, but the side stakes and wire were omitted, about 500 ties being placed on each car.

Trains consisting of from 50 to 70 tie cars were made up at the treating plant, sufficient to cover the tie requirements on each of the divisions terminating at Houston. As the train left the plant yard, the superintendent's business car was at the head end and a cook car and bunk car for six laborers was at the rear. When the train reached the point at which unloading was to begin, the laborers started to slide the ties off, while the train moved at speeds ranging from 10 to 20 miles an hour.

Uses Colored Laborers

The unloading crew consisted of six colored laborers from the tie plant, who were experienced in handling ties. They proved to be adept at sliding the ties from the cars so that they would remain on the shoulder of the embankment and yet not foul the train. It is quite certain that they were superior for this work to Mexican section laborers who are not accustomed to handling ties in quantity, and that the hazard of personal injury was much reduced. The same gang was used on all divisions of the road.

One of the 70-car trains was scheduled to run between Houston and Dallas, 250 miles. The requirements on this territory amounted to 38,000 ties, or an average of 543 ties to the car. It took 34 hr. to do the unloading at the rate of 1,120 ties an hour, or three days of work train service. The roadmaster accompanied the train with a list showing the total number of ties to the mile and how the distribution on each mile should be made. A later check indicated that the unloading had all been done so well that only a minimum amount of shifting was required.

Precautions Were Necessary

Some hazards were presented and certain precautions were necessary in handling a train of 70 flat cars loaded with creosoted ties. In some cases the ties showed a tendency to slip endwise from the cars, so that a few stops were necessary to adjust loads. At meeting points, both trains were instructed to proceed slowly until they were clear. When passing through steel bridges, the train ran at low speed, and the cars were inspected carefully both before and while making the passage. It was rather an impressive sight to see 70 flat cars in a single train, loaded to the practical limit, while the spectacle of ties being unloaded continuously from a train moving at an average speed around 15 miles an hour was, to say the least, rather unusual.

All expectations of the benefits to be derived from this method of distributing ties have been fully met. The ties were all on hand when and where needed for the spring tie renewal program. There has been a reduction in the cost of distribution of approximately $15,000, which comprises loading expense at the treating plant; the saving in unproductive section labor; the reduction in train expenses, including the transporting, setting out and unloading of the ties by revenue trains, and the large amount of overtime that could not be avoided by the older method; a reduction in overtime by the maintenance forces; and some minor items.

We are indebted to E. A. Craft, engineer maintenance of way, for the information presented in this article.

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer? Have you an answer to any of the questions listed here?

To Be Answered in September Issue

1. What methods, if any, can be employed to prevent the blocking of culverts by storm-water deposits?

2. What are the relative advantages and disadvantages of wood and concrete curbs for cinder or screenings platforms at small stations? Should the wood be treated?

3. During the tie renewal season, how much time, if any, should be allotted to smoothing the track? Should this time be regularly assigned or left to the judgment of the local section forces?

4. When driving new bents in an offset position for renewing a pile trestle, is it advisable to shorten the end panels to avoid driving new bents behind the old bulkheads?

5. How should a section gang of six to eight men be organized for cutting the right of way? What incidental work, if any, should be done at this time?

6. What methods can be employed to repair leaks in underground water lines?

7. What methods, if any, can be employed to keep the wing rails on spring frogs closed during hot weather?

8. What type of pump can be used to best advantage for keeping coffer dams dry where the inflow is moderate?

Testing Water Meters

How can a water meter be tested for accuracy in the field or in the water-service shop ?

Large Meters Are a Problem

By C. R. KNOWLES
Superintendent Water Service, Illinois Central, Chicago

It is somewhat of a problem to test meters of large capacity in the field. To do so, various methods are used. At times it is possible to insert a smaller portable test meter in the line and in this manner gage the accuracy of the service meter up to the capacity of the test meter.

Where the water is delivered to a tank of known dimensions or one which can be calibrated, the accuracy of the meter can be tested by running enough water into the tank and comparing the registration with the volume obtained from the calibration of the tank. In other cases, the measuring mechanism of the meter is removed from the meter casing in the line and tested in a similar casing in the shop. Here the necessary adjustments or repairs are made and the mechanism is replaced in the field meter.

A simple shop test necessitates the use of a tank into which the water is discharged and checked against the registration of the meter. For small meters a barrel can be placed on an ordinary platform scale and, after flushing the meter to insure the removal of all air and foreign matter, the empty barrel is weighed. Water is then discharged into the barrel until the dial shows exactly 1 cu. ft. The water is then weighed and the operation is repeated by increments of 1 cu. ft. until the barrel is filled. If 6,250 is then divided by the number of pounds of water weighed for each increment, the quotient will represent the per cent of error of registration. As an example, suppose the weight of any increment as registered is 60 lb. The quotient in this case is 104 and the meter over registers 4 per cent. If, on the other hand, the weight is 69 lb. 6 oz., the meter is under registering by 10 per cent. If the registration is in gallons, divide 8,333 by the weight of the water to obtain the same result.

A typical meter-testing set, for testing meters up to 2 in., includes a tank of 10 cu. ft. capacity, equipped with a water level gage and special fittings to facilitate water connections to the service meters. Various orifice plates are provided for the different rates of flow. These sets can be obtained with or without portable scales. Portable test meters are also available for testing meters in service. The dials on these meters are calibrated to hundredths, insuring accurate readings for small quantities of water.

Accuracy of Registration Is Important

By Water Service Engineer

Accuracy of registration is of the greatest importance, yet it should be borne in mind that few, if any, meters can be made to register to the last degree of accuracy for all velocities of flow, particularly at very high or very low velocities. A meter should register accurately, however, within the limits of the rate of flow for which it is designed, these limits varying somewhat with the size of the meter.

While the best results in testing meters are obtained by weighing the water and comparing it with the registration, this is not always possible or convenient, particularly in the field or with large meters. If the meter is large, it is often satisfactory to discharge the water into the service tank, provided its dimensions have been determined accurately and all outlets have been closed for the period of the test. The measured volume of discharge can then be compared with the registration to determine the accuracy of the latter. It is also desirable

to make comparisons for equal increments of the total discharge. The test should be repeated several times and at different rates of flow to eliminate possible factors of error. If the results of the repeated tests are not consistent, they should be continued until they are, or it is demonstrated that the trouble is in the meter itself.

In some cases it is possible to insert a portable test meter in the line and by this means determine the accuracy of the service meter up to the capacity of the smaller test meter. In general, however, it is better to remove large meters from the line and send them to laboratories which have special facilities for making the tests and such adjustments or repairs as may be necessary.

For smaller meters, the test can be made satisfactorily in the field by inserting the test meter in the line. In the shop, the water can be discharged into a tank or even a barrel and weighed. In this case also the tests should be repeated often enough, and by increments of 1 cu. ft. or 10 gal., to eliminate factors of error. When testing a meter in the shop, a valve should be placed near the outlet side of the meter and so manipulated as to maintain approximately the same pressure as that which is obtained in actual service.

Organizing for Tie Renewals

How should a section gang of six to eight men be organized for renewing ties ?

Made Time Studies of Tie Renewals

By H. S. CLARKE
Engineer Maintenance of Way, Delaware & Hudson, Albany, N. Y.

Seven years ago we made a special study of this subject, taking time studies which were illustrated with pictures of the methods employed by the various foremen. The purpose was to discover and classify the best practice, to deduce the laws covering tie renewals and apply them in such a manner as to standardize practice, with a view to increasing output or decreasing hours of labor or both. As a result of these studies, comprehensive instructions have been issued from which the following has been abstracted:

One man shall go ahead of the gang and pull all spikes from "spotted" ties, except where renewals are heavy and on sharp curves, where the removal of all of the spikes might create a hazard. He then falls back to do such work as may be assigned.

Working in pairs, two men dig out at one side of a tie and through the shoulder, about one inch below the bottom of the tie, and drive it over into the trench. They remove the tie plates and pull the tie clear of the track. If two adjacent ties are to be removed, a single trench will answer for both. If practicable, the ballast from the crib should be thrown back where it can be used for tamping ties already inserted.

Next, the trench is cleared of loose ballast and deepened outside the rail, so that the incoming tie will enter freely without plowing into the ballast. The tie is then pulled in with tie tongs and moved into place. If necessary, the tie is adzed, but never more than is required to get an even bearing.

After it is in place, it should be nipped and tamped snugly against the rail. If tie plates are not used, the rail should be sprung slightly and the tie tamped stiff. If tie plates are used, they should be placed near the ends of the tie for later insertion. If renewals are heavy, it may be necessary to insert the plates and do the spiking at once. If this is done, the rail should not be sprung. Where possible, the foreman should do the nipping to insure that the tie is not raised too high to settle to the old level.

These operations are continued until the day's allotment of ties is inserted. Then should follow, in the order given, the application of the tie plates, full spiking, dressing up the ballast and piling the old ties. At this stage one man should go ahead and distribute the spikes and dating nails.

One man and the foreman pair up. The foreman places the tie plates, while his partner springs the rail with a jack. At joints or at an occasional missing plate, they spring the rail about the thickness of a tie plate and retamp any new ties that were plated and spiked for safety.

Following this, the men, still in pairs, spike the line side and gage. Unless the new ties have been inserted close together it saves time to have the men spike both sides as they advance.

As soon as the spikes are distributed and the tie plates applied, the men engaged in this work fall back and start dressing. As the spikers finish they do the same. The old ties are then piled for burning.

To obtain the best results it is essential that the men work in pairs. For small gangs, the foreman should nip the ties, as this will seldom interfere with his supervision of the work. To avoid interference with each other, the pairs should always be spaced at least a half rail length apart. On the other hand, the spacing should not be too great, as this destroys the spirit of competition, reduces the morale of the gang and increases the difficulties of supervision.

Always Work the Men in Pairs

By H. BECKER
Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

Long experience indicates that the men do more effective work when working in pairs. Each pair should be assigned a rail length and complete every operation from digging out the cribs to tamping the ties, the spikes having been pulled ahead of them. As soon as enough ties are tamped, one pair should drop back and start the spiking. The time that this should be started should be gaged so that they will catch up with the tie spotting about the time it is finished or perhaps a little while after. The insertions should be completed in ample time to permit all track that has been disturbed to be dressed, and any weak places that have developed should be picked up. If the work has been done carefully, little, if any, lining will be necessary.

Make the Organization Fit the Method

By R. ROSSI
Yard Foreman, Chicago & Alton, Chicago

In organizing for any operation it is important that the method be worked out first and then that the organization be developed to carry it out most effectively. It would require too much space to go into all the details of methods and tools. The following organization will do effective work in cinder or gravel ballast:

The foreman should first mark the ties that are to come out. Two men follow with claw bars to remove the spikes, while one breaks down the shoulder at one end of the ties, leaving the cribs undisturbed. Two men follow with light jacks to spring the rail a sufficient

amount to permit the removal of the old tie and the insertion of the new one. With care, this can be done without disturbing the old bed. The remainder of the gang, working in pairs, should remove and replace the ties and later spike and tamp them, after which they should complete the dressing and dispose of the old ties.

This Sized Force Is Effective

By G. D. MAYOR

Assistant Cost Engineer, Chesapeake & Ohio, St. Albans, W. Va.

A foreman and eight men constitute an effective force for spot renewals of ties. Heavy renewals, however, should be made out of face by an extra gang. Six of the laborers are paired, the remaining two handle the jacks and do other miscellaneous work. The pairs work on separate ties, breaking down the shoulder and loosening the ballast in the cribs adjacent to the ties that are to be removed.

When a tie is ready to be removed, the spikes are loosened on adjoining ties and the two jack men spring the rails just enough to permit the tie to be withdrawn. The old tie is removed, the bed prepared and the new tie inserted with tie tongs. The use of picks should never be permitted in handling new ties.

Next, the tie plate is applied and the tie is full spiked, the jack men acting as nippers. Ballast is then forked back into the cribs, the tie is tamped and the cribs and shoulder are dressed. The jack men move from group to group as their services are needed.

The complete cost of the installation by this method, averaged over several years on a heavy-traffic main-line district, is as follows:

	Manhours per tie
Unloading ties from train	0.033
Piling in storage piles	0.050
Installing new ties and piling old ties for burning	0.950
Total	1.033

Repainting Steel Bridges

When repainting steel bridges, to what extent should the old paint film be removed? What is the best method of doing this ?

Sand Blast Is Ideal Method

By E. M. GRIME

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

If one could be certain that all or part of the old paint film is adhering tenaciously to the metal, thus effectively sealing the surface against the inroads of corrosion, removal of the old film would be unnecessary. Usually, however, the surface is blistered in places, indicating that centers of corrosion are present, or there are scattered places where visible rust indicates that corrosion is actively at work. In such cases it is usually desirable to remove all of the old film to insure a satisfactory repainting job.

Cleaning is frequently attempted with wire brushes and scrapers, but this is tiring work and, even with close supervision, workmen are likely to slight it. Furthermore, there are nearly always many parts that are almost inaccessible for hand cleaning.

For really effective cleaning, the sand blast is ideal and is recommended for work of any magnitude. It can be depended on to remove every vestige of old paint, dirt or rust from practically every part of the structure and leave the surface in the condition of new material. Power-driven compressors are now in such common use in regular maintenance work that the arrangements for sand blasting should involve a minimum of expense for new equipment.

In repainting a high steel viaduct, involving 6,849 tons of steel, two brands of paint had been used. One stood up fairly well and the defective spots could be cleaned satisfactorily with wire brushes and scrapers. The failure of the other brand was almost complete, so that the removal of what paint remained was necessary.

Approximately 50 per cent of the surface of the structure was sand blasted. Aside from the compressor operator, who also performed other duties, the labor amounted to about 1 1/3 man-hours per ton of steel cleaned. The air was furnished at 60 lb. nozzle pressure, and 1 cu. yd. of dry sand was required for every 60 tons of steel cleaned.

It should be borne in mind that a thin film of rust will form on a thoroughly cleaned sand-blasted surface in as short a time as 30 min., even in an apparently dry atmosphere. For this reason, it is imperative that the painters apply the priming coat as quickly as practicable after the cleaning of any area is completed.

Depends on the Condition of the Paint

By E. C. NEVILLE

Bridge and Building Master, Canadian National, Toronto, Ont.

In the interest of economy and proper maintenance, repainting should not be delayed until it is necessary to remove all of the old paint film. The paint usually perishes sooner on the top of the floor beams and stringers, on the edges of angles and flanges of beams and around rivet heads, than on plane surfaces. If the repainting is done in time, it is necessary to clean the old paint and rust from only the parts thus affected.

If the repainting has been delayed, however, until the entire surface is spotted with rust, or the old film has lost its elasticity, the film should be removed before repainting. Care must be exercised in all cases to insure that all rust is removed and that the metal is bright for two or three inches beyond the corroded area.

Sand blasting is the surest method of obtaining a clean surface. This does not mean, however, that special or expensive equipment is required. Most roads now include air compressors as part of their regular maintenance equipment, and it is seldom that one cannot be made available for work of this character. The sand blast nozzles can be made or secured at a cost of from $25 to $40.

Do Not Remove More Than Is Necessary

By J. E. BERNHARDT

Bridge Engineer, Chicago & Eastern Illinois, Chicago

Since conditions vary within wide limits as between individual structures, it is impracticable to answer the question fully in general terms. As a rule, I consider it both unnecessary and inadvisable to remove any more of the old paint film than can be removed by the ordinary use of scrapers and stiff wire brushes. Any paint film which adheres so firmly that it is not removed by this method and which can be livened up by the vehicle of the new paint is of a quality that will afford ample protection to the metal. In fact, it should afford more protection than if the new coat is applied to the bare metal. If the old paint film is of such a character, however, or in such condition that it cannot be livened up, it should

be removed. Burning and scraping is the most economical method for small jobs, while sand blasting is most economical for large jobs.

If repainting has been delayed until little of the old film remains, the bare places should be cleaned with a sand blast, at the same time removing what remains of the old paint. Where an appreciable part of the area is void of paint, it is certain that the bare surface is in such condition that the sand blast offers the only effective method of cleaning, and a first class job is practically impossible without removing all of the paint.

Thorough Cleaning Is Important

By ROY HAHN
Clerk to Master Carpenter, Seaboard Air Line, Tampa, Fla.

This question brings up a subject of the greatest importance, which, from long observation, I am convinced is not always given the consideration it deserves. Its importance lies in the fact that proper and thorough cleaning of the steel surface is the secret of a first class job of painting.

Steel surfaces of bridges, or of any other structure for that matter, should never be cleaned, except under the strictest and most competent supervision. The use of scrapers and wire brushes is tedious and the men find it quite tiring. For this reason, there is always a tendency to slight the work unless they are constantly supervised.

Fundamentally, paint is applied to steel bridges for no other purpose than to protect them from corrosion. To do this effectively it must adhere to the surface of the steel. If scale, rust, dirt, dead paint or any other foreign substance intervenes between the paint film and the metal, the paint does not adhere and will blister or rupture eventually, leaving the metal exposed to attack by the elements.

Painting over rust may slow up the process of corrosion somewhat, but it does not inhibit it. Once started, it is progressive and will continue under the unbroken paint film, less actively perhaps than when the metal is exposed to the atmosphere, but none the less persistently. As the rust spot enlarges, a blister forms in the paint, which also enlarges until it is ruptured. For these reasons it is imperative that, in addition to cleaning the exposed rust, scale and dirt from the steel surface, all blisters be removed and that the metal under them be cleaned of all rust in such a manner that bright metal is obtained for several inches around every focus of corrosion.

As paint ages, it perishes progressively. Chalking is the symptom of a natural form of failure which results from the drying and decay of the binder or vehicle. This is the most desirable form of paint failure, however, since it is gradual and does not result from any inherent defect in the paint. In fact, it has a definite advantage, in that it prevents the piling up of thick coats on the surface, while it affords the proper tooth for the anchoring of a subsequent coat.

If the original painting was done properly, if the paint adheres firmly to the metal surface and has not aged to the point where the oil binder is partially or wholly destroyed, it should not be removed. In this condition it will absorb sufficient oil from the new paint to return practically to its original condition. If it has aged to the point where it has lost its elasticity, however, it should be removed entirely, since it does not provide adequate protection and cannot be revived to do so.

Several methods of cleaning steel surfaces for painting or repainting are in vogue. The most common of these is the use of steel scrapers and stiff wire brushes. On smooth surfaces that are not too badly corroded, a satisfactory job can be obtained with these tools, but a special scraper or chisel is needed to clean rivet heads and other irregular surfaces. One disadvantage of their use is the difficulty of doing a thorough job of cleaning in the more inaccessible parts of built-up members.

In my opinion, sand blasting is cheaper than any form of thorough hand cleaning, except for small jobs. This method has the advantage that corners and crevices can be cleaned that no scraper or brush will enter, and other places that are out of the reach of hand tools are made accessible. It should be borne in mind that if such surfaces are left uncleaned, much of the value of the job as a whole is lost. Paint, even of the best quality, affords little or no protection unless it adheres firmly to clean metal. An inferior paint on a clean surface is superior to a good paint on a dirty or rusty surface.

Relaying Rail

When relaying with new rail of heavier section, if the base of the new rail is not more than 5/8 in. wider than that of the old rail, should the old rail be lined to wider gage in advance, or should the new rail be laid on one side of the track against the outside spikes and the gage be corrected when the opposite side is laid ?

New Rail Should be Gaged to Old Rail

By C. W. BALDRIDGE
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

Assuming that the old rails are to correct gage, the new rail should be gaged to the old rail. If the bases of the new and old rails are different, all four lines of spikes will be in different locations. If it is considered desirable to adjust the new rails so that one line of spikes on each side of the track can be reused, this can best be done by laying the first line of new rails to the line of spike holes, either inside or outside, which most nearly preserves the gage of the track, disregarding the gage temporarily, then gaging the opposite rail as it is laid.

Except in unusual cases, only one line of spike holes can be reused, since the gage must be measured at the head of the rail and wider bases will narrow the distance between the bases of the opposite rails.

It is usually advisable to plug the old spike holes and reverse the stagger of the spikes in order to drive them into sound wood. If this is done, there is no object in preserving any line of spikes, and the first string of new rail can be gaged to the opposite old rail and as the new rail is laid on the opposite side it can be gaged to the first new rail.

Does Not Need to Be Gaged in Advance

By Engineer Maintenance of Way

From a study of the question, I gain the impression that it assumes that the rail is to be laid without tie plates. Most jobs of rail renewal today require the renewal of the tie plates as well, if the new rail is of heavier section. In numerous instances, however, combination tie plates are in use so that there is no real need to disturb the tie plates.

In the latter case, say for example the renewal of 90-lb. R-A. rail with rail of the 110-lb. R-E. section,

the new rail can be placed by merely pulling the inside line of spikes and adjusting the gage after the second string is laid on the opposite side. It should be borne in mind in this connection that at present the gage of the old rail is not as wide as in former years. This is particularly true for tangents where modern tie plates are in service, since they have a greater outside bearing, as compared with the older types.

Hundreds of miles of new rail has been laid with the gage left tight, temporarily, as much as ¼-in., with no real harm. In fact, the riding quality of the track has been improved, with no observable increase in the wear on the wheel flanges.

Pull all Lines of Spikes

By W. H. CLEVELAND
General Track Inspector, Atchison, Topeka & Santa Fe, Wellington, Kan.

When relaying new rail of wider base, all lines of spikes should be pulled and the ties adzed properly, which cannot be done if any of the spikes are allowed to remain. Otherwise, the new rail will not be seated properly. The first line of new rail should be gaged at the centers and quarters only, to avoid the possibility of introducing the line kinks that may exist at the joints in the old rail. Only a safe gage is required, and the object should be to seat the first line of new rail in as straight an alinement as possible, avoiding the transfer of kinks from the old rail to the new. When the opposite side is laid the gage should be used at all points that are necessary to obtain correct gage.

Gaging in Advance Wastes Labor

By W. C. ROURK
Section Foreman, Texas & Pacific, Waskom, Tex.

It would be a complete loss of labor to regage the old rail in advance of the rail renewal, in addition to which the ties will be badly damaged by an excess of spiking. Where a wider base rail is to be relaid that would tighten the gage too much, it would be far better to lay both sides of the track simultaneously and keep the track to standard gage at all times.

In any event, if tie plates are to be used, all four lines of spikes must be pulled, unless the plates are double punched to fit both the old and new bases. In the latter case, it is necessary to pull only the inside spikes on the line side. Both lines must be pulled on the gage side, however. In my opinion, it is safe to lay the rail as much as ½ in. tight, temporarily, if done under the proper speed restrictions. This cannot be done, however, through turnouts or on sharp curves. At these places the correct gage should be maintained at all times.

Always Lay the Gage Side First

By N. F. ALBERTS
General Foreman, Chicago, Milwaukee, St, Paul & Pacific, Chicago

If the new rail has a wider base than the old rail, both rows of spikes should be pulled on the gage side and the rail laid first on that side, gaging it from the line side. When the other side is laid, both lines of spikes should be pulled and the gage taken from the opposite new rail. This method eliminates all irregularities in gage that may have existed in the old rail and also tends to minimize irregularities in the line which would have resulted if the line side had been laid first.

If tie plates are not in use, the outside spikes of the line side should be pulled and the rail laid against the inside spikes, disregarding gage. When laying on the opposite side, both lines of spikes should be pulled and this rail laid to correct gage, regardless of the position of the spike holes.

If the tie condition is poor and considerable adzing is required, both lines of spikes should be pulled on both lines of rail to facilitate the adzing. The gage rail should be laid first and gaged, after which the line rail is laid in the same manner and gaged.

Waterproofing

When applying membrane waterproofing, what determines whether 2-ply or 3-ply should be used for any given structure ?

Depends Entirely on Conditions to be Met

By District Engineer

This question cannot be answered in general terms, since every case presents problems of its own. Certain principles, however, underlie all waterproofing. The first is that the waterproofing blanket must be impervious, whatever the external conditions may be. To make the exclusion of water certain, there must be no defects in this blanket as it is applied, and the same care should be observed in the design to insure that none will develop in service.

Since it is not always possible to predict how structures will react to certain conditions or combinations of conditions, waterproofing should be designed for maximum life and to withstand the most adverse conditions that can be foreseen. There are many structures where a 2-ply membrane affords ample protection and where it would be a waste of money to increase the number of plies. There are also structures which, in my opinion, cannot be protected adequately without introducing a third ply to give additional strength to insure against possible rupture or puncture. In every case, however, the decision must be based on a full knowledge of all of the factors involved in the construction and use of the structure as well as of the external conditions which surround it.

Favors the Use of a 3-Ply Membrane

By Division Engineer

I am aware that the proper number of plies of membrane required to produce a dependable job of waterproofing is controversial and that I stand with the minority. I recognize that under many conditions, so far as the waterproofing properties per se are concerned, two plies of membrane properly applied are as impervious to water as a greater number. Yet there are other considerations involved which must often be taken into account.

On a structure where the loads that are applied through the waterproofing are altogether static or no movement in the structure itself is expected, and where the character of the material in contact with the waterproofing can be controlled, I am of the opinion that two plies are usually sufficient. An example is a culvert, a foot subway or similar structure, where the material for

the back filling can be chosen, and where the water to be excluded is under a low head.

On the other hand, there are numerous structures, such as bridge floors, conveyor tunnels or machine pits, where equally satisfactory conditions cannot be obtained. The live loads on a bridge floor are high and are applied with impact. These types of structure are usually subject to considerable vibration and sometimes to a high head of water. Cracks may develop, and movement in expansion and contraction is quite possible. Furthermore, any defect that may develop in the waterproofing is not only difficult but expensive to repair, while it may result in considerable damage. For these reasons, I am of the opinion that three plies of membrane should be applied to structures where the conditions are severe, and that the benefits in insurance against partial or complete failure are ample to justify the added expense.

Uses 2-ply Except at Joints

By G. A. HAGGANDER

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

Our practice is to use 2-ply membrane on all surfaces that are to be waterproofed. At joints where there is a probability that some movement may occur, we add an extra ply to provide additional strength. In our opinion, however, two plies of membrane, with two good moppings of bitumen, affords a completely waterproof blanket, provided the application is made properly. For this reason, we consider it to be for all practical purposes as effective as a 3-ply membrane.

Maintaining a Sod Line

Where a sod line is maintained on the shoulder of the embankment, should it be at the toe of the ballast or some distance from it? If the latter, how far? Should this distance vary with different kinds of ballast ?

Should be Away from the Toe

By C. S. ROBINSON

Engineer Maintenance of Way, Maine Central, Portland, Me.

Good drainage and clean ballast are essential to good riding track. This is brought home especially to those roads that are subject to long periods of freezing temperatures. Where such conditions are encountered, therefore, the sod line should be maintained at a uniform distance, at a minimum of 1 ft. 6 in., from the toe of the ballast. This practice will improve drainage conditions and assist in keeping the ballast clean.

If the ballast section is maintained properly, I do not see the need of varying the distance from the toe of the ballast to the sod line with the type of ballast.

Should Be at the Shoulder of the Roadbed

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

It has been customary on most roads to maintain a sod line wherever it could be held to a definite line. On some roads the sod line is at the toe of the ballast; on others it is at a definite distance from the toe line. The former practice is detrimental to drainage through the ballast and, in my opinion, should not be permitted, since water pockets in the roadbed are often the direct result.

Where a clear strip with a proper outward slope is maintained outside the toe line, drainage is freer and the roadbed dries more quickly. In general, the sod line should be coincident with the edge of the shoulder of the embankment. The width of the clear strip will, of necessity, therefore, vary with different kinds of ballast, owing to the difference in the width of the ballast shoulder, as for example, between stone and gravel or cinders.

Should Not Be at the Toe

By W. H. CLEVELAND

General Track Inspector, Atchison, Topeka & Santa Fe, Wellington, Kan.

A sod line should never be maintained at the toe line of porous ballast, since the ballast is able to perform its functions more completely if it has free and unobstructed drainage. The sod line should be located near the edge of the shoulder of the embankment. This can be accomplished with a minimum of effort and with satisfactory economy by the use of weed-destroying chemicals. The use of scuffle hoes and shovels to keep the roadbed clear of weeds between the ballast and toe line should be prohibited because of the expense and of the waste of soil from the roadbed. If impervious ballast is used, the sod line can be at the toe of the ballast, since it does not then block the drainage.

Satisfactory at the Toe of the Ballast

By G. M. O'ROURKE

District Engineer, Illinois Central, Waterloo, Iowa

To maintain a sod line at any set distance outside of the toe of the ballast entails an extra expenditure of labor and money which, in my opinion, serves no purpose that will justify this extraordinary expense. Where discing machines are used, it is a simple matter to maintain a sod line at the toe of the ballast without involving any extra cost. If a clear strip is maintained outside of the toe line, it is necessary to apply an unreasonable amount of hand labor with shovels or scuffle hoes.

Conserves Ballast, if at Toe Line

By ROBERT WHITE

Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

A sod line is always desirable, if for no other reason than that of appearance. It is also of importance with respect to drainage and wastage of ballast. With rock ballast it should be maintained at a minimum distance of 12 in. from the toe line, and should be kept straight. This can be done with little extra labor, and the strip inside the sod line can also be cleared, when weeding track or dressing the ballast.

Where gravel ballast is in service, it is a great help in minimizing the natural attrition of the ballast shoulder if it is maintained coincident with the toe line. On single track this should be 8 ft. from the center of the track.

A Sod Line Improves Drainage

By R. ROSSI

Yard Foreman, Chicago & Alton, Chicago

In my opinion a sod line with a cleared strip between it and the toe of the ballast is desirable with crushed stone, to improve drainage and conserve the ballast. The width of this strip should not be less than 12 to 14 in.

Where the ballast is gravel or cinders, a uniform grass line should be maintained at the toe of the ballast. With

these types of ballast, it is impossible to prevent the finer parts from spreading out and eventually working over the shoulder of the roadbed. Where this occurs a measurable amount of the ballast is often washed over the shoulder during a hard rain. For these reasons it is better practice to make the sod line coincide with the toe line of the ballast.

Main-Line Frogs

What are the relative advantages and disadvantages of spring-rail and rigid frogs for main-line service, with respect to riding qualities and economy of maintenance ?

Spring-Rail Frogs Have Longer Life

By Chief Engineer Maintenance of Way

Our experience with these two types of frogs has indicated that each has certain advantages and certain disadvantages, depending upon the conditions under which it is used. Spring-rail frogs have much better riding qualities and a longer life than rigid frogs under normal conditions of use. Furthermore, their first cost is less than that of the manganese-insert type of rigid frog, which is the design commonly used for main-line service, thus resulting in appreciable economy.

Generally speaking, the spring-rail frog should be used where 75 per cent or more of the movements are on the main line. Where the preponderance of the traffic is on the main line, rigid frogs have a relatively short life and are not economical. This type of frog is apt to ride rough, even though well maintained, particularly in high-speed territory.

Lubrication and maintenance of the moving parts of the spring-rail frogs and the necessity of stocking right and left-hand units are the principal disadvantages of this type. They also tend to become noisy under traffic after considerable wear.

Rigid frogs, on the other hand, are simple in construction and require only nominal maintenance. Any unit may be used in either right or left-hand turnouts, and in low-speed territory they have a long life and are economical.

Spring-Rail Frogs Ride Smoother

By C. W. BREED

Engineer of Standards, Chicago, Burlington & Quincy, Chicago

There can be no question as to the superior riding qualities of the spring frog, which is due to the absence of the turnout flangeway which always gives an undesirable jar to the passing equipment. It has been our experience that spring frogs placed in the track at the time the rail is laid will last as long as the rail itself. As against this, at least one replacement, and frequently two, of rigid frogs is necessary during the life of the rail.

Often there are places, such as at the ends of passing sidings or at junctions, where the main-line and turnout traffic are about equal, where the use of spring-rail frogs is not desirable. This may be either because of the excessive amount of wear or because a frog of smaller angle than is practicable in a spring frog is desirable, in either of which cases a rigid frog should be used.

Spring frogs have been in use in the main tracks of the Burlington over a period of 30 or 40 years, regardless of the density of traffic or speed of trains, without having caused an accident. This is ample reply to the objection that is sometimes raised that it is undesirable to have a spring of any kind in track equipment. The exception to this practice is, however, the locating of a spring frog in the outer rail of a curve, without a sufficient length of guard rail to protect it.

In our later spring-frog construction, we are providing a flangeway of 2 in., which further improves the riding qualities, in that there is no drag of the wheel flange through the frog, as occurs at times with the standard flangeway.

Rigid Frogs Often Wear Rapidly

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Spring frogs have definite advantages with respect to smooth-riding qualities and wear in main-line service, provided they are properly designed and constructed. Frogs of this type should have a wide solid plate extending not less than 48 in. back from the frog point to the heel, and should be bolted with heat-treated bolts. The rail braces and guides, as well as the point rails should be securely riveted to the base plate. Elsewhere, other plates should be similarly fastened to conform to the standard tie spacing. There is no reason why train movements should not be made over such a frog without jar. With proper maintenance, a frog of this type will have a remarkably long life.

On the other hand, owing to the distance between the point and the throat—amounting to about 25 in. on the commonly-used No. 10 frog—over which the wheel has a minimum of support, it is next to impossible for a rigid frog to ride smoothly. This condition is aggravated by the fact that the standard guard rail holds the wheels away from the point an amount sufficient to bring the roughest outer part of the wheel tread over the point which is thus struck a heavy blow by every passing wheel. The result is that the point is soon pounded down and the riding qualities are constantly being degraded. I have in mind a situation where two facing point frogs, one of each type, were installed only a short distance apart, where physical and traffic conditions were identical. Although both frogs were constructed of 130-lb. rail, the rigid frog began to show definite signs of wear and crushing very shortly, while as yet, the wear on the spring frog can scarcely be detected.

Rigid Frogs for High-Speed Turnouts

By W. C. ROURK

Section Foreman, Texas & Pacific, Waskom, Tex.

For high-speed service, spring frogs have decided advantages over those of the rigid type, in both riding qualities and lower maintenance or replacement costs. This statement holds good for frog numbers up to and including No. 11, provided the traffic through the turnout side is relatively light. Where speed requirements necessitate easier turnouts, as at junction points or diversion cross-overs for high-speed trains, and frogs from No. 12 to No. 20 are used, they should be of the rigid type.

Objections are often raised to the use of spring frogs in the outer rails of curves. My observation is that these objections are sometimes based on improper guard-rail protection. Guard rails should be long enough and so located that they guard the full length of the wing rail, since it should never be subjected to a lateral thrust from the wheel flanges while a train is moving on the

main-line track. Many guard rails are set back too far, thus placing the protection behind the frog point instead of ahead of it where it is needed.

The principal objection to rigid frogs is the pounding they receive from wheels as they move across the throat and strike the point. The damage from this cause is not so pronounced as the frog number increases. The principal disadvantage of spring frogs is the tendency of the wing to jam open when rails creep from expansion or other causes. Of less importance is the continual slapping of the wing rail as trains move through the turnout.

Rigid Frogs do Not Ride Smoothly

By H. BECKER

Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

I am of the opinion that rigid frogs should never be used in main-line service except where the traffic through the turnout is relatively heavy or where high-speed movements must be made on the turnout side, in which case longer turnouts and high-numbered frogs are required. Rigid frogs in high-speed tracks cannot be made to ride smoothly, even with the best of maintenance, while a properly maintained spring frog should ride as smoothly and have as long life as the adjacent rail.

Furthermore, maintenance effort and maintenance cost are less for spring frogs over the period of their service life, than for rigid frogs during a comparable period. Again, where rigid frogs are used, the general maintenance on the turnout is increased.

Retreating Pile Heads

Should pile heads that are to be used as foundations for frame buildings be returned to the treating plant for treatment or retreatment? Why ?

The Cost Should Be Analyzed

By W. A. SUMMERHAYS

Manager, Forest Products Inspection and Research Bureau, Illinois Central, Memphis, Tenn.

In my opinion, the first problem to be considered in the disposition of pile heads is to determine or keep records of ground penetration and then order piles as nearly as possible to the exact length that will be required. It is common practice on railways to protect the freshly cut surface of piling with hot creosote and coal tar pitch, so that there should be no difficulty or inconvenience in treating the pile head in the same manner. Assuming that the piling has been properly treated with complete sap-wood penetration, a treated pile head should last as long as the piling in the bridge. Care should be exercised in the handling of treated pile heads, to avoid needless expense, which might make them cost more than new treated timber direct from the treating plant.

The Benefit Does Not Warrant the Cost

By ROY HAHN

Clerk to Master Carpenter, Seaboard Air Line, Tampa, Fla.

Speaking from long experience and as the result of a special study of this subject, I fail to see the advantage of the practice suggested in the question. In our own territory the supply of pile heads is in excess of the demand for foundation work. The best of the pile heads should be given immediate treatment with hot creosote and protected with coal tar and roofing paper. Those not needed for immediate use should be shipped to a central point where they can be stored under sanitary conditions until needed. In this section of the country where decay of untreated material is rapid, pile heads treated in this manner have an indefinite life. The cost of rehandling and retreatment is so high that it would be more economical to construct permanent piers of brick or concrete.

Thinks the Cost Would Not Be Justified

By A. L. BECKER

Architect, Gulf Coast Lines, Houston, Tex.

I am of the opinion that the cost of handling and retreatment can not be justified on the ground that a sufficient extension of the life of the timber can not be secured. I am basing this opinion on the fact that we are constructing permanent concrete foundations for a cost only 10 per cent greater than that of pile-head foundations.

Depends on Method of Use

By L. H. HARPER

Superintendent of Treating Plant, Central of Georgia, Macon, Ga.

If the pile heads are from untreated piles, I would say by all means to send them to the plant for treatment before they are used as foundation posts for frame buildings.

If they are cut off from treated piles and it is practicable to frame them in advance to the exact lengths in which they are to be used, it would also pay to return them for retreatment because of the benefit they would receive from end penetration. If, on the other hand, it is considered necessary to frame them on the job, this advantage would be entirely lost and the expense of handling and retreatment would not be justified. Wherever it is necessary to cut into treated timber, the exposed untreated surface should be given several applications of hot creosote.

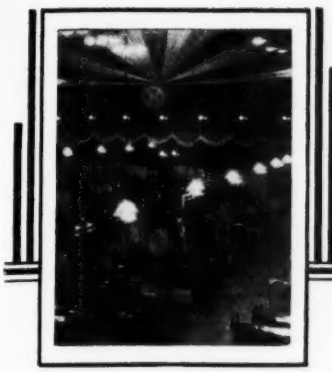
Does Not Favor Retreatment

By R. H. GILKEY

Division Engineer, Central of Georgia, Savannah, Ga.

I do not consider it necessary to retreat pile heads that are to be used for foundations under frame buildings. The untreated surface exposed in cutting the pile should receive immediately two applications of hot creosote and one of hot tar. Over this there should be placed a layer of roofing felt with the edges lapping at least two inches over the side. A second coat of tar should then be applied. In this manner, the cut surface will be sealed effectually and the growth of decay-producing fungi prevented. The cost of this method is negligible, as compared with the cost of rehandling and retreatment.

How Much Elevation Should a Track Foreman Give a Spring Frog if it Is in a Swamp?



NEW AND IMPROVED DEVICES

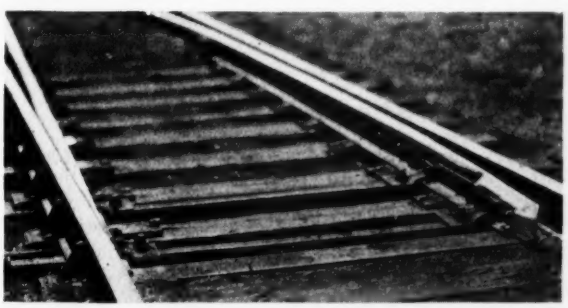
A New Hammerhead Boom

THE Northwest Engineering Company, Chicago, has recently developed a hammerhead boom for steel erection purposes that is used in connection with crawler equipment. While this type of boom has been used on locomotive cranes in the past it is claimed that this is the first time that it has been applied to crawler equipment. The new boom is provided with sheaves for a five-part line and is designed to keep the load away from the boom structure. As shown in the illustration these booms are available in great lengths.

The New Boom

New Switch Point Protector

THE Woodings Forge & Tool Company, Verona, Pa., has put on the market a new manganese steel switch point protector, that is designed to be fastened directly to the switch point and to protect it from traffic in either direction. The new protector is a relatively flat casting with tapered ends, one of which lies close to the switch point, while the other forms a new wearing point for the tip of the switch rail. The protector requires no special



A Switch Equipped with the Woodings Protector

or extra fastenings, nor the drilling of holes, being fastened entirely by bolts supplied with it, through holes normally provided in the switch point.

The installation of the protector is effected by first removing the bolts holding the No. 1 clip of the switch point, and by cutting out the rivet or rivets ahead of this clip, which secure the reinforcing strap to the point. The protector is then slipped between the clip and the reinforcing strap and bolted in place. New bolts, spring washers and cotter keys are supplied with the protector. The new protectors are supplied either right or left

A Close - Up of the New Protector

handed, and are subject to wear only when the switch is in service. They should be applied to new or slightly used switch points, and are best suited for service in low-speed, heavy-traffic tracks.

Grinder With a Flexible Shaft

A PORTABLE gasoline-engine driven track grinder with a flexible shaft has been developed recently by the Stow Manufacturing Company, Inc., Binghamton, N. Y. This grinder is designed for general use around frogs and switches and may also be employed in connec-

The Stow Portable Grinder

tion with the building up of rail ends. It consists of a 22-hp. gasoline engine mounted on a light frame which is designed to facilitate the handling of the unit from place to place. The frame is constructed of two parallel tubular members, bent somewhat in the form of a U with suffi-

cient length at each end to permit the equipment to be carried by two men. The power unit is carried in the depression of the frame on two sections of steel channel. The engine has an adjustable speed of from 1,400 to 2,200 r.p.m. and the net weight of the equipment is 176 lb. A variety of flexible shaft attachments, such as grinders, drills, rasps, drums and wire brushes, are offered with this equipment.

Rigid Rule Winds in Case

A SIX-FOOT steel tape that winds automatically into a 2-in. steel case but is said to be rigid like a rule when withdrawn has recently been brought out by the Lufkin Rule Company, Saginaw, Mich. This device, which is known as the Crescent Tape-Rule, is made in two types, No. 696 and No. 696D, which are differentiated by the manner in which they are graduated, the former being graduated in inches and sixteenths and the latter in tenths and hundredths of a foot.

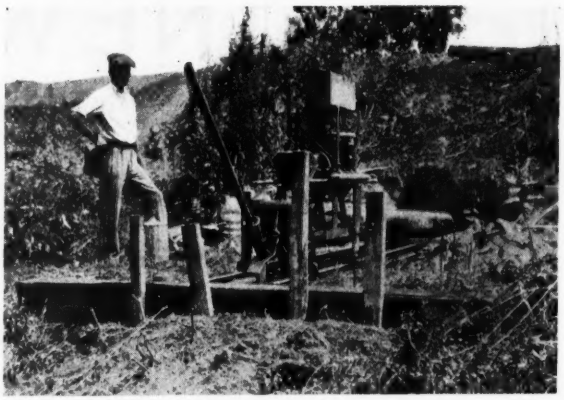
The Crescent Tape Rule

The blade of the rule is made of super-quality tempered steel, which has been stiffened by special forming. It is nickel plated and has prominent dark markings. The case is chromium plated and has a spring-winding device with a ratchet stop. It is claimed that the rule will flex around and accurately measure circular, round-cornered and variously-shaped objects. The end of the rule is equipped with a hook for taking measurements out of reach.

Armco Develops Boring Machine

AFTER a number of years of development and experimental work the Armco Culvert Manufacturers Association, Middletown, Ohio, has perfected a boring machine for installing corrugated iron drain pipe in 8, 12 and 18-in. sizes under railway and other embankments. The machine consists of a gasoline-engine powered boring unit mounted on a short section of track and forced forward on rollers by a hand-operated jack. The jack is situated at the rear of the machine and operates on a rack located between the rails on which the machine moves. The track together with the rack is braced securely at the rear to prevent slipping.

The boring power is transmitted to the cutter head through the pipe that is being installed, by means of a shaft around which is constructed a spiral conveyor for removing the spoil. During its removal through the pipe, the spoil is carried on a smooth metal trough. When a section has been inserted to its full length in the embankment, the machine is moved back to the starting point and another section, together with an additional length of shaft and trough, is attached.



The New Armco Boring Machine in Service

Although the principal purpose of this machine is the installation of pipe for subdrainage purposes, it has also been found applicable to the installation of conduits for gas, water, telephone, electric light and other lines for which small diameter pipe is satisfactory.

Develops New Convertible Machine

THE Bucyrus-Erie Company, South Milwaukee, Wis., has recently placed on the market its new 37-B, 1¼ to 1½-yd. machine, convertible to shovel, drag-line, crane or clamshell operation. This unit is designed for operation with Diesel, gasoline, or electric power, and the shovel may be equipped with either a rope or chain crowd. The dragline may be provided with either regular

The New Bucyrus - Erie No. 37-B

or special extra long and wide mountings for work in soft ground. It is said that the convertibility of the machine is of the simplest possible type and thus saves time in changing over for different types of work.

The notable features of this machine include unit steel construction, ball bearings on all continuously running shafts, oversize clutches, gears enclosed and running in oil, a box girder boom and single-shaft drive caterpillar mountings. In addition it is equipped with power set hoist clutches, oversize brakes with cooling fins, double-operating chocking brakes on caterpillar mountings and controlled from the operator's seat, a swing brake for operating on grades, three-side vision for the operator, a steel cab, an inserted-tooth dipper, two bearings only to a shaft, a power dipper trip, a self-starter for the engines, and a self-locking power boom hoist. All operating levers toggle in, and the machine is steered from the operators' seat with the cab in any position.

Fairmont Develops New Type of Track Maintenance Unit

A NEW type of track maintenance unit, known as the Fairmont Mogul, which is intended for use primarily as a ditcher and ballast shaper, but which is also adapted for the performance of a number of unrelated operations, has been developed by Fairmont Railway Motors, Inc. It is essentially a gas-electric locomotive mounted on an all-steel flat-decked body, 46 ft. long, which is designed especially for the attachment of ballast shapers, ballast plows, scarifiers and ditcher wings. The fact that it is self-propelled and has ample tractive power and speed, makes it possible to save the cost of

Duplicate Wings Permit Ditching in Either Direction

a steam locomotive for work train service when it is engaged in ditching and other maintenance operations, while when not needed for maintenance work, it can supply emergency power for switching or train service.

To determine the performance of this unit and the economy it demonstrates, observations were made while it was employed in regular service, shaping the ballast and roadbed and ditching cuts over a period of 11 days. Of the total crew time of 115 hr. 30 min., the machine actually worked 59 hr. 20 min., giving a factor of actual use of 51.4 per cent. The total mileage run by the machine was 565.5, while the actual working mileage was 88.2. The total gasoline consumption was 783 gal., or an average daily consumption of 71 gal. Ten gallons of lubricating oil were consumed at the rate of 0.91 gal. a day.

In this period of 11 days, a total of 86.7 miles was shaped on one side, equivalent to 43.35 miles of single track shaped on both sides. The total time actually engaged in shaping was 51 hr. 20 min., equivalent to 1 hr. 11 min. for shaping one mile of single track on both sides. Ditching was completed over a combined distance of 7,000 ft., from which 1,410 cu. yd. of material was removed. A total of 8 hr. was consumed in this operation, or at the rate of 875 ft. of ditch and 176 cu. yd. of material an hour.

Detailed records were kept of the cost of each of these classes of work. An overhead charge of $61.50 a day was made, based on the assumption that the unit will be used a total of 200 days a year. This charge includes interest at 6 per cent, depreciation 15 per cent, annual maintenance 10 per cent and running repairs 10 per cent. The make-up of the crew and the rate of wages per hour were as follows:

	Rate per hour
1 Conductor	$ .82
1 Flagman	.65
1 Engineer	.94
1 Operator	.60
1 Laborer	.43
Total hourly labor cost	$3.44

Based on a day of 10 hr. 30 min., the average daily crew time, and allowing time and a half after 8 hr., the cost of operation for one day was:

Overhead	$ 61.50
Labor	40.42
Fuel, 71 gal. at 7 cents	4.97
Lubricating oil, 0.91 gal. at 60 cents	.55
Miscellaneous supplies	1.00
Total daily cost	$108.44

An average of 4.56 miles of equivalent single track was fully shaped on both sides in a 10-hr. 30-min. day, giving a cost of $23.78 a mile for shaping the roadbed. The average working time was 5 hr. 24 min. a day, during which 950 cu. yd. of material was removed from the ditches that were cleaned. On the basis of a total charge of $108.44 a day, the cost per yard was 11.4 cents for ditching.

On a straight run of 434 miles made recently by one of these cars over four railways, the total running time, eliminating delays, was 17 hr. 45 min., an average speed of 24 m.p.h. The total gas consumption was 140 gal. or at a rate of 3.09 miles to the gallon.

There are five major assemblies in the unit, consisting of (A) the front and rear trucks, either of which can be removed from the body in 30 min.; (B) the frame, which is electrically welded into one solid structure; (C) the power plant, which is mounted on a sub-frame and which can be removed as a unit through a panel in the front of the cab; and (D) the cab, which is also electrically welded into one piece and bolted to the frame, so that it can be removed entirely.

The front and rear trucks are identical, both being arranged for electric-motor drive. The power plant, as installed, has a capacity of 175 hp. As motive power requirements increase, however, all that is necessary is to add another engine and generator, room for which is provided in the cab, or exchange the existing set

The Wings Fold Compactly Against the Body

for another, up to 350 hp., and mount two additional motors on the rear truck. Owing to the weight of the unit, 86,500 lb., the adhesion to the rail is sufficient to double the tractive effort.

In attaching the ditching and ballast shaping wings, a special frame upon which these wings are mounted, is applied to the body of the unit by means of bolts or pins. All vertical and swinging movements are controlled hydraulically under an oil pressure of 400 lb. to the square inch. Heavy hinge-pins which are attached to the frame, permit the swinging movements to be made readily and allow the wings to fold against the

body of the car when not in use. The wings are held in correct lateral position while engaged in ditching or shaping by means of an oil pressure cylinder on one side and a steel cable on the other.

Duplicate wings, separated by a diaphragm which forms a pocket holding about eight cubic yards, are employed in ditching, thus making it possible to work in either direction in any cut. With this unit, ditching is not performed by bulldozing, as specially designed ¾-in. high-carbon manganese-steel cutting edges are applied at the bottom edges of the wings. As they cut through the earth in the ditch, it rolls back into the pocket, which, when filled, is discharged on the shoulder of the embankment beyond the end of the cut. Top hinged doors with ample opening, which open inwardly,

Shaping the Ballast and Shoulders of the Roadbed

to permit the entrance of the excavated material, are inserted in each of the wings to prevent the material in the pocket from passing through to foul the ditch.

Similarly the ballast shaper, which is operated in the same manner as the ditcher wings, is provided with two pockets which, together, will hold approximately 5½ cu. yd. of ballast. The purpose of this feature is to salvage the extra ballast on shoulders that are too wide and hold it for distribution in filling out slack places and narrow shoulders. The shaper can be set at any angle or vertical or horizontal position to conform to the contour of the ballast shoulder.

In addition to ballast shaping, ditching and other operations in which the roadbed is worked mechanically, by the application of the proper equipment the Mogul can also be made to serve as a snow plow, a flanger, or an electric crane.

To provide space for the various maintenance appliances which can be used wth this unit and facilitate their operation, the power plant is grouped at the front end, leaving two-thirds of the length of the car available for such installations. As a further convenience, to provide a deck and car bottom clear for work equipment, all of the air-brake apparatus is concealed in the frame between the 12-in. channels which form the center sills, but in such manner that it is open to immediate inspection.

This unit is designed and built in accordance with recognized railway standards and practices. The design permits the standards of any railway to be met with respect to safety appliances, trucks, draft gear, braking equipment, sanders and other special equipment not made by Fairmont Railway Motors. This permits repairs or replacements to be made from stock materials in any shop on a system without waiting for special parts.

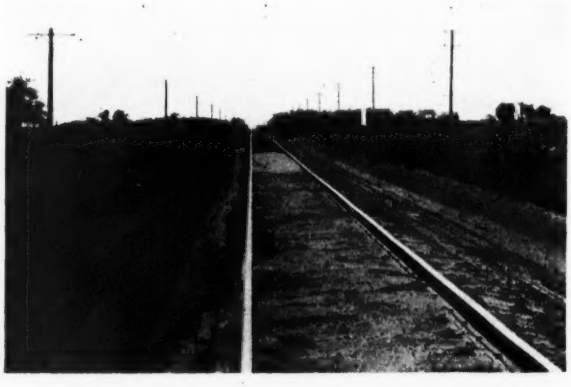
Because of its construction, this unit can be placed in any part of a freight train for shipment or for transfer to another job. To do this, the gears of the traction motors are disconnected and the air line coupled, after which it will move as an ordinary freight car. To return it to service it is only necessary to run the compressor for a few minutes to charge the braking system.

Since all removable parts are located in the steel cab, which can be locked, it is unnecessary to run the unit to a terminal or employ a watchman overnight. The regular supply tanks carry sufficient fuel and lubricating oil for 24 hours' continuous service, so that by eliminating the delays incident to running for coal and water as well as by convenient tie-ups overnight, the factor of productive use is increased as much as 25 per cent.

The Hall-Scott Model-175 gasoline engine was selected as the prime mover of the power assembly, although any other type of engine which balances with an available electric generator of the proper size, can be furnished to meet the standards of any railway. General Electric, 250-volt, series-wound traction motors of the electric-locomotive type are used for driving units. The engine, generator and radiator are spring-mounted on an electric-welded steel sub-frame, which is bolted to the car frame. Six large rubber cushion pads are inserted between the two frames to absorb the vibrations.

The maximum drawbar pull on sanded rails is 21,000 lb., and on smooth rails it is 12,500 lb. The effective drawbar pull when moving ranges from 10,000 lb. at 2 m.p.h. to 1,000 lb. at 25 m.p.h. The unit, operating as an electric locomotive, will, therefore, handle a gross train load of 1,600 tons on level track at 2 m.p.h., or 170 tons at 25 m.p.h. The tonnage rating on a 2 per cent grade at these speeds is 208 tons and 22 tons respectively. The maximum free-running speed of the unit with the motors in gear is 30 m.p.h., and out of gear 60 m.p.h.

The overall length of the car body is 49 ft. 5 in., and over the end sills 46 ft. 1 in. The maximum width is 10 ft. 1 in. The frame is constructed of 12-in. 30-lb.



Ditching Completed and Roadbed and Ballast Shaped

channels, and rests on cast-steel body bolsters which are reinforced with similar channels. The deck consists of a ¼-in. plate having a non-skid surface.

Brakes, draft gears, trucks and other similar equipment all conform to the A.R.A. standards, while the safety appliances meet the requirements of the I.C.C. rules. The couplers are of the locomotive type. The 250-volt generator has a continuous rating of 350 amperes. The engine throttle is of the locomotive type and is placed within easy reach of the driver's left hand. The motor controller is of the series-parallel type in both directions, and is provided with a safety lock which prevents the opening of the controller until the generator is cut in on the switchboard.

NEWS OF THE MONTH

New Organization to Seek Regulation of Buses and Trucks

An organization formed for the purpose of furthering a national movement looking to more stringent regulation of buses and trucks, and known as the "National Association for Regulation of Buses and Trucks," has been formed at Paris, Ky. This organization, which proposes to seek members all over the country, has filed articles of incorporation (without capital stock) with the clerk of Bourbon county at Paris.

Fast Freight Train to Challenge Mail Service

A fast freight service which it is claimed will make it difficult for the shipper to get the invoice to the consignee by mail before the freight arrives at his door has been announced by the Boston & Maine and the New York, New Haven & Hartford between Portland, Me., and New York City, about 345 miles. This service is to be furnished by a night freight train, known as the Maine Bullet, which will make the run in 12½ hr., thus effecting an improvement of about 24 hr. in this service.

New Cars and Locomotives are Fewer

In the first four months of 1931 the Class I railways of the United States placed 5,330 new freight cars in service as compared with 34,987 in the same period last year, according to the Car Service Division of the American Railway Association. New locomotives placed in service in the first four months numbered 39, as against 283 last year. On May 1, the Class I roads had 8,554 new freight cars on order, compared with 33,723 on the same day a year ago. New locomotives on order on May 1 this year totaled 81, as compared with 362 on May 1, 1930.

Four Months Freight Traffic Lower

Freight traffic handled by the Class I railways of the United States in April amounted to 28,709,632,000 net ton-miles, a reduction of 17.7 per cent under April, 1930, and of 25.1 per cent under April, 1929, according to reports compiled by the Bureau of Railway Economics. Freight traffic handled in the first four months of 1931 amounted to 116,049,854,000 net ton-miles, a reduction of 17.8 per cent under the corresponding period of 1930, and of 25.6 per cent as compared with the first four months of 1929.

I. C. C. Authorizes Lower Rates on Refined Petroleum Products

The railroads have secured permission from the Interstate Commerce Commission to reduce rates on certain commodities sufficiently to permit them to meet the growing competition of other transportation agencies. This applies to a recent decision of the commission authorizing the railroads operating in the Mid-Continent oil fields to establish rates on refined petroleum products 25 per cent less than the basic rate in cases of clear-cut competition on the part of truck or pipe lines.

Safety Committee Stresses Flying and Falling Objects

The Committee on Education of the Safety Section, American Railway Association, through L. G. Bentley, its chairman, proposes in Circular No. 302, that railway safety committees and all railway employees place particular emphasis in July on the prevention of those accidents classified as resulting from "Flying and Falling Objects, and Material Dropped or Thrown." The circular lists 18 suggestions, one of which advises the use of signs reading "Workmen Overhead" while another suggests that workmen subject to foot injuries wear safety shoes.

Rail Employees in April Show Increase Over March

The number of employees on the payrolls of the railroads of the United States in April totaled 1,331,405, an increase of 12,091 as compared with March, but a decrease of 15.34 per cent as compared with April, 1930, and of 20.06 per cent as compared with April, 1929, according to the Interstate Commerce Commission. This was the second consecutive month in which railway employment has shown a slight increase after a long succession of decreases since last May, the increase in March over February having been 2,821. The number of maintenance of way employees in April was 22.84 per cent less than in April last year.

New Haven Considers the Use of Seaplane Service

The inauguration of seaplane passenger service in co-ordination with its trains operating between New York and Boston, Mass., is now under consideration by the New York, New Haven & Hartford, according to officers of this road. This service, however, will not be placed in operation unless a definite demand for it develops.

Two Roads Extend Store Door Service

The railroads are continuing to extend their store-door pickup and delivery services in an effort to meet highway competition. The Union Pacific and the St. Joseph & Grand Island, through a subsidiary, the Union Pacific Stages, Inc., have established a co-ordinated railway and highway service for l.c.l. freight between points in Nebraska. This service includes pickup and delivery by trucks and transportation between cities by rail. Likewise, the Southern Pacific Motor Transport Company, a subsidiary of the Southern Pacific Lines in Texas, has extended its l.c.l. pickup and delivery service to points in the Lower Rio Grande Valley and to stations on the transcontinental line between Del Rio, Tex., and El Paso.

Movement of Winter Wheat Expected to be Large

The winter grain crop of Texas, Oklahoma, Kansas, Nebraska, Colorado, and Missouri, which, according to government forecasts, will amount to about 368,071,000 bu., an increase of 12½ per cent over last year, began to move about June 15 and it is estimated that the movement will materially exceed that of last year. For some time the railroads serving these states, including the Chicago, Rock Island & Pacific; the Atchison, Topeka & Santa Fe, the Missouri Pacific; the St. Louis-San Francisco; and the Missouri-Kansas-Texas, have been accumulating cars in this territory

in preparation for the movement. A number of these roads have greatly increased the employment and activity in their car repair shops to insure sufficient cars to fill the demands of shippers.

Empire Builder Was Derailed by a Tornado

Somewhat unusual conditions were involved in the derailment of the Great Northern's Empire Builder, enroute eastbound between Seattle, Wash., and Chicago, on May 27, when it was struck by a tornado while moving at a speed of 40 miles an hour. The train, which was traveling on a low embankment about five miles east of Moorhead, Minn., was thrown on its side in the form of a semi-circle with the observation car near the track and the mail car about 90 ft. from the track. One passenger was killed, 3 were seriously injured and 45 passengers and 9 employees received minor injuries. The track was practically undamaged, most of the couplings were unbroken and the electric lights in the cars remained burning after the accident. The locomotive was untouched and proceeded to the nearest telegraph station to report the accident.

Real Earnings of Railway Employees Show Increase

During the last quarter of 1930, both average hourly and average weekly real earnings of the railway employees of the United States were higher than in any other recorded period during the last 17 years, according to a tabulation of statistics made by the National Industrial Conference Board. By "real" earnings is meant the actual money earnings expressed in terms of the cost of living, in other words an expression of the purchasing power of the dollar. With 1923 as a base, it was found that real weekly earnings in 1930 were 7.9 per cent above the 1923 level, and that in 1929 they were 6.9 per cent above this level. In the first quarter of 1931, the real hourly earnings of railway employees recorded an increase of 5.3 per cent as compared with the last quarter of 1930, while the real weekly earnings increased by 3.7 per cent.

I. C. C. Warns Communities Against Diverting Patronage

Communities that are now served by railroads have been warned recently by the Interstate Commerce Commission that they cannot expect to retain this means of transportation and at the same time give their patronage to others. This statement was made by the commission when it denied the application of the Sumpter Valley for authority to abandon 20 miles of its narrow-gage line in eastern Oregon, which had been operated at a loss for several years. However, the commission intimated that if the next few years did not see an improvement in the traffic on this section, the road would probably be allowed to abandon it. The commission stated that the right of each community to use those means of transportation which it prefers cannot properly be questioned by anyone, but that it must realize the consequence of withholding patronage from the other forms of transportation that serve the community.

Extension of Container Car Service Planned on Pennsylvania

The Pennsylvania has announced that in the near future it will extend its container car service for merchandise freight to all important points on the system. This service is now operated between the New York metropolitan area and the principal points on the Eastern region of the Pennsylvania, as well as the Pittsburgh, Pa., Columbus, Ohio, Cincinnati, Indianapolis, Ind., and Chicago. In preparation for the expansion of this service, orders for more than $1,500,000 of additional merchandise containers will be placed at once. A total of 3,250 containers are included in the order, all of which will be built in the shops of the railroad. At present, 1,010 containers, each having a capacity of 10,000 lb., are in service on this road. These containers are carried on specially-constructed flat cars having a capacity of five containers each and a possible capacity carload of 25 tons. Besides greatly expediting package freight movement, this service enables the freight to be carried direct to the door of the consignee.

Track Supply Association to Boost Railroads

In recognition of the fact that there is much that can be done by railway supply companies to assist the railways of this country in their effort to meet the competition of other transportation agencies, the executive board of the Track Supply Association has issued a letter to its members calling their attention to the situation and requesting their co-operation in a program designed to improve conditions. The Track Supply Association is an organization founded for the purpose of exhibiting track appliances and equipment at the annual conventions of the Roadmasters and Maintenance of Way Association of America. The letter suggests that the members of the Track Supply Association agree to insist that all shipments into and out of their plants be made by rail; that all purchase orders of each company shall bear the inscription "Ship by Rail;" that as far as possible the officers and employees of the companies shall travel by rail; that the companies as corporations and their employees as individuals shall request the support of their state legislators and congressmen toward the proper regulation of competing agencies; and that by all suitable means each company shall educate its employees and their friends to the necessity for laws and regulations that will permit the railroads to continue to function.

First T-Rails and Crossties Now in One-Hundredth Year

The first railroad track to consist of T-rails spiked to wood crossties is now in its one-hundredth year of existence, having been laid in 1831, according to a recent announcement of the Pennsylvania. This track is a portion of that of the old Camden & Amboy, which was constructed originally in 1831 between Bordentown, N. J., and South Amboy and later extended to Camden. A 300-ft. length of the line, paralleling the present tracks of the Pennsylvania, to which the road was leased in 1871, is visible at Jamesburg, N. J. At the time this line was laid the only type of rail design known consisted of strap iron fastened to wood stringers. However, Robert L. Stevens, first president of the road, discarded this idea and developed a crude conception of the modern T-rail, which weighed 40 lb. a yard and was rolled in 16-ft. lengths. At the joints, the rails were supported on wrought iron plates and were connected by iron tongues, five inches long, which were riveted to the rail ends. At first these rails were supported on stone blocks two-feet square, but when the supply of these blocks failed, as a temporary expedient the rails were spiked to hewn wood crossties. These gave such satisfactory service that they were permitted to remain and gradually displaced the stone blocks.

A 300-Ft. Length of the Orignal Camden and Amboy Track As It Appears Today

ASSOCIATION NEWS

Metropolitan Track Supervisors' Club

The Metropolitan Track Supervisors' Club held its annual outing at Asbury Park, N. J., on June 20, with 65 members and guests present. At the meeting which was the last for the summer, E. E. Oviatt, chief engineer of the New York, New Haven & Hartford, was elected an honorary member, and the following new officers of the club were chosen: President—F. W. Biltz, supervisor, Reading; first vice-president—W. O. Dennis, inspector maintenance of way, Lehigh & New England; second vice-president—T. E. MacMannis, supervisor, Central of New Jersey; and secretary-treasurer—W. E. Gadd, The Rail Joint Company.

Ties Producers Association

President E. E. Pershall has addressed a letter to L. C. Dyer, member of Congress from St. Louis, Mo., refuting statements made by Mr. Dyer in a recent widely quoted interview regarding a bill which he proposes to introduce at the next session of Congress requiring the railways to use steel ties for the purpose of conserving the forest resources. In his letter Mr. Pershall emphasized the fact that there is no shortage of timber for crossties, that the average life of a wood tie is steadily increasing by reason of preservative treatment and that the demand on the forests for crossties is being reduced proportionately. He also emphasized the dependence of large areas on tie production as its main industry.

American Railway Engineering Association

The Palmer House was again selected as the place of meeting for the convention of the American Railway Engineering Association, to be held in Chicago on March 15-17, 1932, in accordance with arrangements ratified by the board of direction at a recent meeting. At the same meeting two past presidents were elected to honorary membership, namely, Hunter McDonald, chief engineer of the Nashville, Chattanooga & St. Louis, and Charles S. Churchill, formerly chief engineer and later vice-president of the Norfolk & Western.

Nine committees held meetings during the month of June. The committees on Ballast and on Economics of Railway Labor, met on June 5—the former at Cleveland, while the latter met at Pittsburgh, devoting part of the day to an inspection of rail-laying operations on the Pennsylvania in that vicinity. The committee on Uniform General Contract Forms met at New York on June 19, and the committee on Records and Accounts met at Cleveland on the 23rd. During the week beginning with June 21, four committees held meetings in Chicago, the committee on Masonry on June 24 and 25, the special committee on Waterproofing on June 25, and the committees on Grade Crossings and on Wooden Bridges and Trestles on the 26th. The committee on Yards and Terminals met at Niagara Falls, Ont., on June 29.

A bulletin which will be mailed early this month, will contain monographs by two members of the association, one by J. L. Campbell, chief engineer of the Northwestern Pacific, on "The Cost of Moving Trains Against Rolling, Rise and Fall, and Curve Resistances" and another by W. J. Burton, assistant to chief engineer of the Missouri Pacific, on "Tie Renewals."

Wood-Preservers' Association

More than 40 members of the Wood-Preservers' Association and the Committee on Wood Preservation of the American Railway Engineering Association met at Ottawa, Ont. on May 26-27 in the annual spring meeting of these organizations. After filling certain vacancies in committees and after receiving progress reports from the committees on the Processing of Wood and on Preservatives, the Executive committee gave detailed consideration to the formulation of the program for the annual convention which will be held in St. Louis, Mo., next January. At a dinner on the evening of the first day, Hon. R. J. Manion, minister, department of railways and canals, Dominion of Canada, spoke on the problems confronting the Canadian railways.

President John S. Penney has also written Congressman Dyer emphasizing the economic value of the wood crosstie industry to the country and picturing the present need as the development of markets for the ties now being produced from timber unsuited for other uses. He also stressed the fact that timber, like any other crop, must be cut at the proper time if it is to be of value. He cited the fact that the acreage of forest land required to provide the crosstie requirements of the railways had decreased 33 per cent in the last 20 years and estimated that this saving will approximate 50 per cent by 1940.

Roadmasters' Association

All of the officers, several members of the executive committee and the chairmen of several committees, a total of 12 in all, met at Hotel Stevens, Chicago, on June 27, for the purpose of advancing the plans for the convention to be held at the same place in September. Preliminary drafts of four of the committee reports were read and discussed, and a tentative list was prepared of speakers to be invited to present papers or addresses at the convention. It was also decided to post a question box in the convention hall and devote part of one session to a general discussion of the questions received.

PERSONAL MENTION

General

E. C. Gegenheimer, trainmaster on the Akron division of the Pennsylvania, and an engineer by training and experience, has been promoted to superintendent of the Sunbury division, with headquarters at Sunbury, Pa.

F. L. Thompson, vice-president on the Illinois Central in charge of the Chicago Terminal Improvements and of the valuation department, and formerly chief engineer of this road, has had his jurisdiction extended to include the construction department of the system.

Paul J. Neff, assistant to the president of the Missouri Pacific and vice-president and general manager of the Missouri Pacific Transportation Company, and formerly chief engineer of the Texas lines of the St. Louis-San Francisco, has been appointed also assistant vice-president in charge of traffic of the Missouri Pacific Lines. Mr. Neff, whose headquarters are at St. Louis, Mo., was born on July 14, 1884, at St. Louis, and graduated from the University of Kansas in 1906 with a degree in civil engineering He entered railway service in February,

Paul J. Neff

1907, as a rodman on the Frisco and after being advanced through the positions of transitman and assistant engineer, was promoted to engineer of construction in 1910. In 1917 he was promoted to district engineer at Springfield, Mo., and in 1918, during federal control of the railroads, he became corporate chief engineer of the Frisco at St. Louis. In 1920, Mr. Neff was appointed general manager of the Wichita Falls, Ranger & Ft. Worth and the Wichita Falls & Southern. He became chief engineer of the Texas lines of the Frisco in 1921 and in 1922 he was appointed assistant to the president of the International-Great Northern at Houston, Tex. From 1925 to 1926 he served as

assistant executive vice-president of the same road and in the latter year he was appointed general superintendent of the Eastern district of the Missouri Pacific, with headquarters at St. Louis, becoming assistant to the president on September 1, 1928. In November of the same year, Mr. Neff was appointed also vice-president and general manager of the Missouri Pacific Transportation Company, the motor coach operating subsidiary of the Missouri Pacific. His further appointment as assistant vice-president of the Missouri Pacific Lines became effective June 1.

Henry D. Pollard, vice-president and general manager of the Central of Georgia, whose career embraces long experience in the railway engineering and maintenance of way fields, has been elected president of this road, with headquarters as before at Savannah, Ga. Mr. Pollard was born on October 4, 1872, at Aylett, Va., and was educated at Aberdeen Academy and at the University of Virginia. He commenced railway service in 1892 as a rodman on the Baltimore & Ohio, subsequently going with the

Henry D. Pollard

Ohio Southern (now the Detroit, Toledo & Ironton) as assistant resident engineer. In 1893 he became assistant engineer maintenance of way of the Philadelphia division of the B. & O. and from 1899 to 1911 he served successively as transitman, resident engineer, supervisor, trainmaster, roadmaster and superintendent on the Central of Georgia. In 1911, Mr. Pollard went to South America as inspector general of the Auxiliare Railway at Port Alegre, Brazil, returning to the United States in 1913 as valuation engineer of the Central of Georgia. Two years later he became president of the Wrightsville & Tennile Railway, but returned to the C. of G. in 1918, as assistant general manager, serving in this position and as general manager until March, 1920. On that date he was appointed general superintendent and held this position until January, 1924, when he was advanced to general manager. In October, 1925, Mr. Pollard was further promoted to vice-president and general manager, holding this position until his recent election to the presidency.

Engineering

J. P. Head, assistant district engineer of the South Texas district of the Missouri-Kansas-Texas, with headquarters at Waco, Tex., has retired.

L. V. Chausse, division engineer of the Second division of the Oregon-Washington Railroad & Navigation Co., with headquarters at La Grande, Ore., has been appointed division engineer of the Oregon division, with headquarters at Portland, Ore., following the consolidation of the First and Second divisions under the name of the Oregon division.

The position of division engineer on the Canadian National at Capreol, Ont., has been abolished and the duties of that position have been taken over by **C. H. N. Connell,** district engineer with headquarters at North Bay, Ont. **H. J. Black,** division engineer at Capreol, has been transferred to the Hornepayne division, with headquarters at Hornepayne, Ont., succeeding **H. L. Benson,** who has been transferred.

R. P. Graham, superintendent of the St. Louis division of the Pennsylvania, with headquarters at Terre Haute, Ind., has been appointed engineer maintenance of way of the Central Pennsylvania division, with headquarters at Williamsport, Pa., succeeding **D. P. Beach,** who has been appointed assistant to the chief engineer maintenance of way of the Eastern Region, with headquarters at Philadelphia, Pa.

A. W. Galbreath, valuation engineer of the Missouri-Kansas-Texas, with headquarters at St. Louis, Mo., has resigned and has opened an office at St. Louis for the practice of utility and railway valuation engineering in connection with recapture, tax and rate cases and the reorganization of such properties.

F. M. Siefer, division engineer of the Stockton division of the Southern Pacific, with headquarters at Stockton, Cal., has been appointed assistant division engineer of the Western division at Oakland Pier, Cal., following the consolidation of the Stockton division with the Western division. Mr. Siefer succeeds **W. H. Phelps,** who has been transferred to the Coast division with headquarters at San Francisco, Cal., where he replaces **H. A. Lathrop,** who has been transferred to the Salt Lake division at Sparks, Nev. **W. Riseden,** assistant division engineer of the Stockton division, has been transferred to the San Joaquin division with headquarters at Bakersfield, Cal.

Schuyler M. Smith, assistant bridge engineer of the Wabash, with headquarters at St. Louis, Mo., has been appointed bridge engineer of the Missouri-Kansas-Texas, with the same headquarters, succeeding **Ross Malcomb Stubbs,** whose death was noted in the June issue. Mr. Smith has been engaged in railway and bridge engineering work for the past 20 years. He was born at Manchester, Mich., on April 21, 1888, and graduated from Armour Institute of Technology in 1911. Mr. Smith obtained his first railway experience on the Chicago & North Western in 1911. Shortly thereafter he was connected with the Isthmian Canal Commission and in 1913 he was appointed assistant engineer on the Wabash. From 1917 to 1919 he served as a captain in the engineer corps of the United States Army, where he designed a pontoon footbridge that was

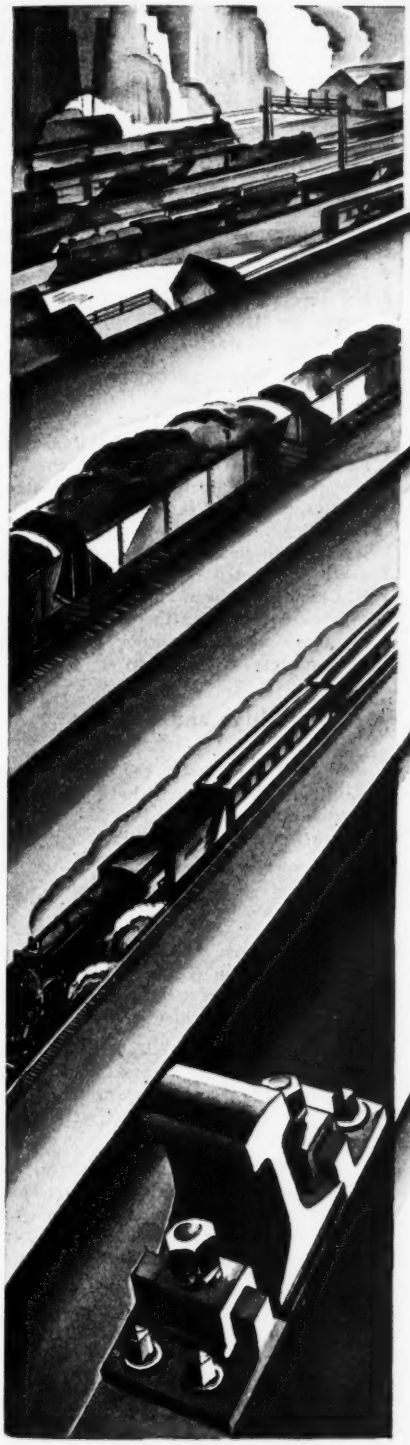
Schuyler M. Smith

used extensively in the Argonne offensive. He re-entered railway service in 1919 with the Wabash, when he was appointed principal assistant engineer, with headquarters at St. Louis. In 1922, he left railway work to enter the service of the American Bridge Company, where he remained until 1924, when he returned to the Wabash in the bridge engineer's department. Several years ago Mr. Smith was advanced to assistant bridge engineer which position he held until his appointment as bridge engineer of the M-K-T on June 1.

O. V. Derr, general office engineer of the Erie, has been appointed valuation engineer, with headquarters as before at New York. Mr. Derr was born on April 27, 1885, at Needham, Mass., and received his education at the Stevens school and at Stevens Institute of Tech-

O. V. Derr

nology. He began his railroad career in July, 1904, with the Baltimore & Ohio, holding several positions in the location and construction departments, until September, 1906, when he was appointed assistant engineer of the New York divi-



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GEO TRACK CONSTRUCTION

sion. From July, 1908, to March, 1910, he served as assistant engineer of the New Jersey and Lehigh divisions of the Lehigh Valley, re-entering the service of the B. & O. in March, 1910, and remaining until December of that year. From that date until July, 1911, he served as field engineer with Eyre-Shoemaker, Inc., railroad contractors, at Philadelphia, Pa., and during the next seven months served as construction inspector on the Boston & Albany. In February, 1912, he entered the service of the Erie as a resident engineer and served in this position and as first resident engineer until March, 1918. From this date until August, 1919, he served as captain of engineers with the United States Army in France. He returned to the Erie on the latter date as resident engineer, and in June, 1929, he was appointed general office engineer of the system, which position he held until his recent promotion.

Fransisco Malagamba, division engineer of the Monterrey-Golfo division of the National of Mexico, with headquarters at Monterrey, N. L., has been also appointed division engineer of the Monclova division. **Manuel Salazar Arce,** division engineer of the Chihuahua division at Chihuahua, Chih., has been transferred to the Jalapa division, with headquarters at Jalapa, Ver. **C. C. Foncerrada y Basave,** engineer of construction, with headquarters at Tampico, Tam., has been appointed division engineer of the Cardenas division, with headquarters at Cardenas, S. L. P. **Ricardo Lelo de Larrea** has been appointed division engineer of the Mexico-Queretaro division, with headquarters at Queretaro, Qro.

Heron Cabrera, whose promotion to chief engineer of the National of Mexico, with headquarters at Mexico, D. F., was noted in the May issue, has been in the service of those lines for more than 13

Heron Cabrera

years. He was born at Leon, Gto., in September, 1885, and graduated from the National Engineers School in 1907. For the following three years he was engaged in the practice of civil engineering under a consulting engineer on the location of the Rio Frio Railroad and on various construction projects, including drainage work at Morelia, Micho. Mr. Cabrera obtained his first experience with the National of Mexico in February, 1910, as assistant to the resident construction engineer. Shortly after this service he acted as a member of the United States-Mexico boundary commission, returning to railroad service in September, 1915, as division engineer on the National of Mexico at Aguascalientes, Ags. Later he was transferred to San Luis Potosi, S. L. P., where he remained until September, 1916, when he was appointed assistant to the chief engineer, maintenance of way and structures. From 1917 to 1920, he served as assistant superintendent of the Aguila Oil Company, inspector of natural products of the Mexican department of industry and commerce in Yucatan and Lower California, and was engaged in private irrigation and drainage projects. In January, 1921, he was placed in charge of the Demarcation committee of the National of Mexico at the Port of Tampico, which included jurisdiction over water supply and the wharves and lands of the railroad at that point. Nine years later he was appointed engineer in charge of right of way of the National of Mexico, with headquarters at Mexico City, a position he held until his promotion to chief engineer.

Track

E. B. Reddy, roadmaster on the St. Louis district of the Missouri-Kansas-Texas, with headquarters at Harrisonville, Mo., has retired.

E. R. Shultz, supervisor of track on the Pennsylvania, with headquarters at Ravenna, Ohio, has been transferred to Dennison, Ohio, where he succeeds **R. L. Chaney,** who has been transferred.

Michael Sheahan, supervisor of track on the Illinois Central, with headquarters at Rantoul, Ill., retired on April 30, after 35 years of service with this road.

A. G. Ayers, track foreman on the Canadian National, with headquarters at Brandon, Man., has been appointed acting roadmaster at Swan River, Man., succeeding **R. Dennis,** who has been transferred to the Winnipeg terminals, with headquarters at Winnipeg, Man.

P. Shaw, assistant supervisor of track on the Minneapolis & St. Louis, with headquarters at Hopkins, Minn., has been promoted to supervisor of track, with headquarters at Estherville, Iowa, to succeed **F. B. Clark,** who has been transferred to Ft. Dodge, Iowa. Mr. Clark succeeds **J. W. Zettelmier,** who has been transferred to Monmouth, Ill., where he succeeds **George Teyro,** who has in turn been transferred to Hopkins, Minn., succeeding **James Teyro,** who has resigned after more than 50 years service with this road. The position of assistant supervisor of track at Hopkins has been discontinued.

Mr. Shaw was born on November 9, 1900, at Salt Lake City, Utah, and after a public school education commenced railway service on March 1, 1917, as a track man on the Illinois Central at Sherwood, Iowa. He served in this capacity at various points on the I. C. until June 1, 1921, when he resigned to enter the service of the Chicago & North Western as a trackman at Boyer, Iowa. On April 1, 1922, Mr. Shaw was advanced to assistant track foreman and served in this position and as relief foreman until April 1, 1923, when he was further promoted to track foreman. On March 17, 1926, he resigned to go with the Minneapolis & St. Louis in the same capacity with headquarters at Grand Junction, Iowa, being promoted to assistant supervisor of track at Hopkins on November 1, 1929. His promotion to supervisor of track was effective June 1.

B. F. Wright has been appointed roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Topeka, Kan., succeeding **W. A. Simpson,** who has been granted a leave of absence on account of ill health. **M. H. Bootjer,** roadmaster, with headquarters at Manly, Iowa, has been transferred to Rock Island, Ill., to succeed **J. L. Jensen,** whose death was noted in the June issue. **H. B. Cassidy** has been appointed construction roadmaster on the new Polo-Birmingham line of the Rock Island, with headquarters at Polo, Mo.

Bridge and Building

W. E. Love, master carpenter on the Baltimore & Ohio, with headquarters at Connellsville, Pa., retired on May 1, after 49 years of service with this road.

Obituary

G. S. Stewart, roadmaster on the Chicago, Burlington & Quincy, with headquarters at Beardstown, Ill., was killed in a motor car accident on May 31.

J. O'Connor, who retired in 1928 as a roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Ft. Worth, Tex., died on May 1, at Denver, Colo.

W. Ruth, supervisor of track on the New York Central, with headquarters at New York City, died at his home at Port Washington, Long Island, New York, on April 12, at the age of 65 years.

W. A. Parker, formerly a division engineer on the Union Pacific and at one time assistant superintendent and chief engineer of the St. Joseph & Grand Island, died on April 23, at his home in Omaha, Neb.

H. A. Middaugh, formerly superintendent of bridges and buildings of the Seattle, Lakeshore & Eastern (now part of the Northern Pacific) and at one time superintendent of construction of the White Pass & Yukon, in Alaska, died at Seattle, Wash., on May 27, at the age of 84 years.

John C. V. Christensen, design engineer for the Cincinnati Union Terminal Company, with headquarters at Cincinnati, Ohio, died at Ocean Grove, N. J., on June 16. Mr. Christensen, who was a native of Denmark, had previously

served as designing engineer for the Gulf, Florida & Alabama (now part of the St. Louis-San Francisco) at Pensacola, Fla., and had been engaged in the design of the New York Central passenger station at Buffalo, N. Y.

John Copeland, formerly superintendent of bridges and buildings on the Chicago, St. Paul, Minneapolis & Omaha, died on May 9 at his home in Minneapolis, Minn.

Lorenzo D. Smith, retired supervisor of bridges and buildings on the Norfolk division of the Norfolk & Western, died on April 12. Mr. Smith was born in Reynoldsville, Pa., on April 18, 1853, and began his railroad career on construction work in 1872, with the Low Grade division of the Alleghany Valley Railroad. In 1877, he went to Australia where he was connected with the Great Southwestern Railroad, with headquarters in New South Wales. From Australia Mr. Smith returned to the United States where he became associated with the New Mexico and Southern Pacific, and later with the Pennsylvania. He entered the service of the Norfolk & Western on September 1, 1890, as master carpenter, his position later being changed to supervisor of bridges and buildings, in which capacity he continued until his retirement on April 18, 1923.

Frank S. Stevens, formerly engineer maintenance of way of the Reading, with headquarters at Reading, Pa., died on May 26. Mr. Stevens was born on December 7, 1850, and entered the service of the Reading as division engineer at Reading on November 12, 1897. On October 1, 1900, he was appointed superintendent of the Reading and Lebanon divisions with the same headquarters, and five years later was transferred to the Wilmington & Columbia division. On October 17, 1910, Mr. Stevens was promoted to engineer maintenance of way, which position he was holding at the time of his retirement on November 1, 1923.

Frank S. Stevens

Aurelio Chavez, chief engineer of the National of Mexico, with headquarters at Mexico, D. F., whose death was noted in the May issue, had been engaged in railway and mining engineering work for 21 years. He was born at Huitzuco, Gro., in 1881, and attended high school in Mexico City. During 1910 and 1911, he served as a civil engineer on railroad construction in the state of Guerrero, and in the following year he was appointed assistant division engineer on the National of Mexico at Torreon, Coah. From 1913 to 1915, Mr. Chavez was connected with a mining company and in 1916, he returned to railroad service in the engineering department of the National of Mexico. Here he was advanced through various positions, including that of engineer maintenance of way of the system. He was promoted to chief engineer in May, 1930.

Fred M. Bisbee, former chief engineer of the Western lines of the Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex., who retired from active duty on November 1, 1922, died at his home at Hollywood, Cal., on May 4. Mr. Bisbee was born at Brunswick, Me., on September 27, 1853, and graduated from the University of Maine in 1876. Two years later he entered railroad service as a rodman on the Santa Fe. Thereafter he served successively as superintendent of construction of the Mexican Central, superintendent of track laying of the Santa Fe, superintendent of track, bridges and buildings of the Gulf, Colorado & Santa Fe, superintendent of track, bridges and buildings of the St. Louis & San Francisco, general manager and chief engineer of the Tennessee Central, general manager of the Los Angeles Land & Water Co., and engineer for B. Lantry & Sons, railroad contractors at Fort Madison, Iowa. In 1904, he was appointed engineer on the Western lines of the Santa Fe at La Junta, Colo., where he remained until 1913, when he was promoted to chief engineer of the Western lines at Amarillo.

Fred M. Bisbee

The Railway Equipment and Machinery Mart has been organized to make it possible for manufacturers to display their products in the St. Louis Mart building now being constructed on the southwest corner of Twelfth boulevard and Spruce street in St. Louis, Mo.

SUPPLY TRADE NEWS

General

The Wood Conversion Company has opened a railroad sales office at 149 California street, San Francisco, Cal. in charge of **O. J. Stevens.**

The Truscon Steel Company of Canada, Ltd., has opened an office at 620 Vancouver block, Vancouver, B. C. **E. G. Ryley** has been appointed manager.

Poor & Company, Chicago, has announced that June 6 marked the twenty-fifth anniversary of the company. The original company later developed into the P. & M. Company and then into Poor & Co. Since the founding of the firm its management has not changed.

An arrangement has recently been concluded by the **United States Steel Corporation** with **Fried, Krupp, A. G.,** Germany, whereby the subsidiary companies of the Steel Corporation are licensed by Krupp under various patents of Strauss, Johnson, Armstrong, Fry, Kuehn and Smith for rust-resisting and heat-resisting and other alloy steels, and for the heat treatment thereof. This arrangement, which includes the collaboration of Krupp with respect to technical matters in connection with corrosion-resisting and heat-resisting steels, etc., will apply to the products of the **Illinois Steel Company, the Carnegie Steel Company, the American Steel & Wire Company, the American Sheet & Tin Plate Company, the National Tube Company,** and **the Lorain Steel Company.** The major products manufactured by these companies in corrosion-resisting and heat-resisting steels include shapes, plates and bars, strip, wire products, rope, sheets, tubes and castings.

Personal

R. W. Rusterholtz, South African manager of the Ingersoll-Rand Company, with headquarters at Johannesburg, South Africa, died on June 12.

Frank Baakes, Jr., a representative of the American Steel & Wire Company, with headquarters at Cincinnati, Ohio, has resigned to become a representative of the **Keystone Steel & Wire Co.,** Peoria, Ill., at Chicago.

J. R. Crocker, for a number of years district manager of the **Permutit Company,** New York, who has been associated with the company since 1913, has been appointed special western railroad representative, with headquarters at 215 Pershing Road, Kansas City, Mo., and **W. R. Toppan** has been appointed special eastern railroad representative, with office at 332 South Michigan avenue, Chicago.

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Same frog after being welded with TIMANG Manganese Welding Rod in the track.

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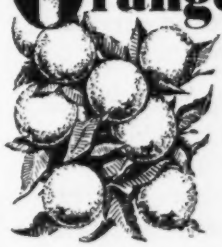

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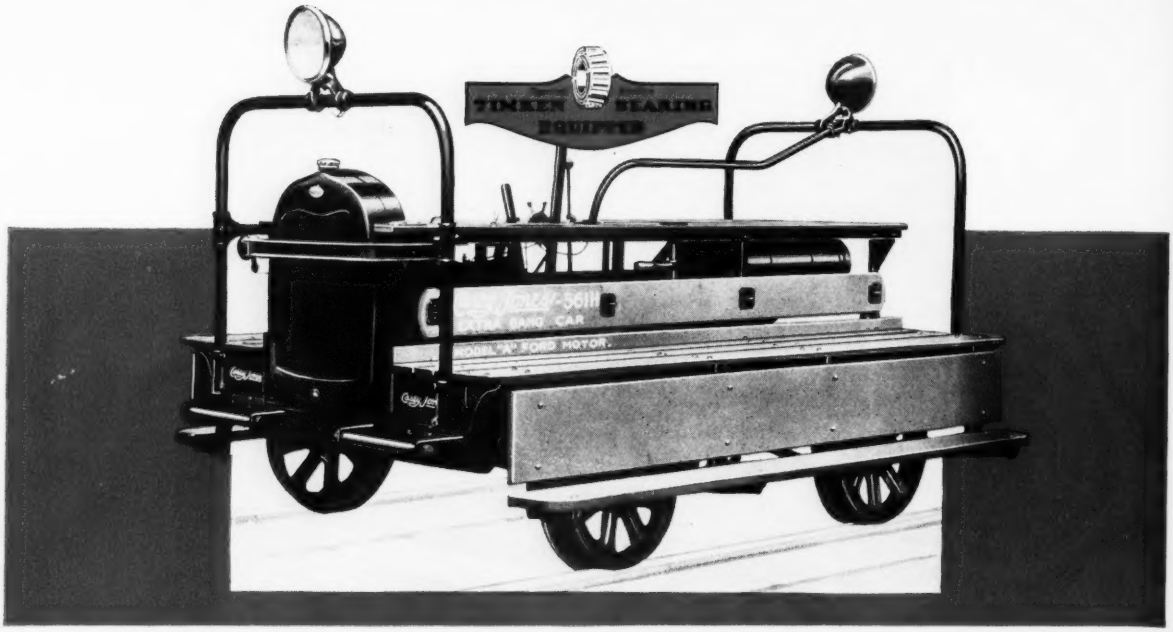

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